ABSTRACT

Christopher Weikart, THE IMPACT OF THE NORTH CAROLINA FUTURE READY CORE GRADUATION REQUIREMENTS ON HIGH SCHOOL MATHEMATICS COURSE ENROLLMENT PATERNS, COLLEGE MATHEMATIC READINESS, AND POST HIGH SCHOOL INTENTIONS (Under the direction of Dr. Marjorie Ringler). Department of Educational Leadership, March 2015.

The study examined high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions during the planning and implementation of the Future Ready Core high school graduation requirements in North Carolina public school systems. Quantitative methodologies were utilized to describe the impact of the increased, uniformed high school graduation requirements with proportions and averages of graduates in the state of North Carolina of graduates completing three or more college preparatory math courses, Scholastic Aptitude Test (SAT) math scale scores, and graduates indicating intent to attend a two or four-year college. Additionally, the study looked at the proportions and averages by district sized based subgroups (small, mid-sized, and large) for each indicator. The data sources included the entire population of North Carolina public high school graduates between 2008 and 2013.

The study's findings presented two major findings for school leaders. The implementation of the more uniform, rigorous Future Ready Core graduation requirements positively impacted the proportion of graduates completing three or more college preparatory course more immediately than previous new policies' implementation; however, the substitution option was selected 16.39% of the time at the state level in 2013 with higher percentages in small and mid-size school districts. Additionally, the decrease in student performance on the SAT math assessment even with increases in college preparatory coursework requires school leaders to examine the quality of teaching and learning as well as potential unofficial tracking methods

that may be occurring in the more uniform graduation requirements. Further research studies on the impact of the Future Ready Core graduation requirements could include analysis of total math coursework, repeating a similar study using ACT math composite scores after three graduating classes under the new requirements, or conducting a case study of districts who have had positive trend data while implementation the Future Ready Core graduation requirements as an exemplar for other school districts to follow.

THE IMPACT OF THE NORTH CAROLINA FUTURE READY CORE GRADUATION REQUIREMENTS ON HIGH SCHOOL MATHEMATICS COURSE ENROLLMENT PATTERNS, COLLEGE MATHEMATIC READINESS, AND POST HIGH SCHOOL INTENTIONS

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THE IMPACT OF THE NORTH CAROLINA FUTURE READY CORE GRADUATION REQUIREMENTS ON HIGH SCHOOL MATHEMATICS COURSE ENROLLMENT PATTERNS, COLLEGE MATHEMATIC READINESS, AND POST HIGH SCHOOL INTENTIONS

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DEDICATION

This dissertation is dedicated to my family. To my Mom, Patricia Burns, who provided me with loving devotion as a child and a reinforcing encouragement as an adult to finish my doctorate program, I will always be grateful for your steady handed support and steadfast belief in my ability to attain a bachelors, then masters and now my doctorate. To my children, Austin, Ethan, and Emma, always remember that all of your dreams and aspirations are attainable with determination and perseverance. I look forward to watching and supporting your pursuit of your dreams. To my sister, Abby Haddix, I thank you for your love and support as I have pursued this journey. I could not have asked for a better sister. To my stepfather, David Burns, I am thankful that you chose my sister and I to raise as your own. Your calming voice of reason will always be appreciated.

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CHAPTER 1: INTRODUCTION

In September of 2008, the North Carolina State Board of Education revised the high school graduation requirements to the Future Ready Core for freshmen starting in 2009 (Graduation requirements, 16 NCAC 6D .0503 2009). From that point forward, high school graduates were required to complete four college preparatory math courses consisting of Algebra I, Geometry, Algebra II, and one advanced math course. In limited situations, students were allowed to substitute two math courses with identified career technical education courses. The revised requirements within the Future Ready Core aligned with national recommendations set forth by the American Diploma Project and the National Governor's Association (2004) which designated that all high school graduates must complete a college preparatory course of study. In addition, the revised requirements were supported by research that shows positive correlations between high school students' test scores and post-high school readiness when students were enrolled in more uniform rigorous course requirements (Adelman, 1999; ACT, 2012; Chaney, Burgdorf, & Atash, 1997; Lee, Robert, & Smith, 1997; Teitelbaum, 2003; Warburton, Bugarin, & Nunez, 2001).

The Future Ready Core graduation requirements differed from previous revisions made in the year 2000 in the amount and level of rigor in mathematics. In the 2000 graduation requirements, students selected from four preparatory pathways including a career option, career tech option, university preparatory option, or an occupational option based on their post- high school plans (NCDPI, 2001). The differences in the career option, career tech option, and university preparatory option were the level of mathematics required, an elective career specialization, and a foreign language requirement. More specifically, the career preparatory pathway required the completion of Algebra I while the career tech preparatory pathway required

completion of Tech Math II and the University preparatory pathway required the completion of Algebra II and two foreign languages. The fourth pathway was designed for students with special needs. Occupational preparatory pathway required special education math courses. In contrast, the Future Ready Core graduation requirements starting in 2009 have all students following the same pathway. The Future Ready Core pathway required the completion of Algebra I, Geometry, and Algebra II plus one advanced math course with a limited substitution option of replacing the last two math courses with identified career technical education courses.

Throughout the education reform era dating back to the early 1900s, educators, researchers, and policy makers proposed increasing high school graduation requirements, content standards, teacher competency, length of school day, and length of school year. Since the 1980s, policy makers most commonly chose to increase high school graduation requirements as an education reform strategy (Bracey, 2009). Increasing high school graduation requirements as compared to other recommendations was often selected due to cost efficiency and the assumption of a causal effect to increased student achievement (Bracey, 2009; Clune & White, 1992; Chaney et al., 1989; Schiller & Muller, 2003; Sebring, 1987). The Future Ready Core graduation requirement adoption in 2008 was another occurrence in ongoing education reform.

Impact of Increasing High School Graduation Requirements

Over the past thirty years, the majority of the states in the United States implemented policy changes in secondary education that increased high school graduation requirements. The policy changes included increasing the total number of courses needed for high school graduation as well as increasing the number of higher-level core classes in math, sciences, and foreign languages. Increasing high school graduation requirements meant that students were expected to successfully complete higher-level courses. States and school systems added mid-

level courses to help students learn pre-requisite content or to remediate those students who were not expected to successfully learn the higher level of coursework. However, according to transcript studies, the additional graduation requirements generally increased course enrollment in remedial or mid-level courses taken at the beginning of the college preparatory sequence as a result of multiple preparatory pathways within the increased graduation requirements (Clune & White, 1992; Publication of Education Trust, 1999; Sebring, 1987). Remedial or mid-level courses lacked the rigor to prepare a student for college or the workforce. In mathematics, mid-level or remedial courses were increased to replace Geometry and Algebra II. Examples of mid-level courses included business or technical math (Lee & Burkham, 2003).

As the high school graduation requirement increased over the course of the past thirty years, the United States faced a financial hardship due to the expense of college and workforce remediation as well as lost revenue to international competition from an underprepared workforce. Community colleges, universities, manufacturing industries, and researchers reported the need for increased remedial programs for high school graduates upon entering their programs (ACT, 2004; Conley, 2007; Greene & Winters, 2005; Strong American Schools, 2008; Wise, 2008). Achieve, Inc., and the National Governors Association (2005) projected 16 billion dollars were lost annually in college and workforce remediation. Strong American Schools Projects (2008) projected 2 billion dollars were lost annually in productivity from an underprepared work force. Furthermore, North Carolina Community Colleges experienced increases in community college remediation rates and costs of underprepared high school graduates. During the 2011-2012 academic year, 69% of freshmen enrolled in at least one remedial course in North Carolina Community Colleges (Liston, 2012). During the 2012-2013 academic year, college remediation courses accounted for 105 million dollars of community

colleges budgets of which 58 million dollars were directly state funded (B. Schneider, personal communication, January 8, 2014).

Statement of Problem

Considering the past national trends of high school course enrollment patterns when high school graduation requirements were increased, and the current state of increased college remediation course enrollment, this study will describe the impact of the Future Ready Core graduation requirements on high school mathematics course enrollment, college mathematic readiness, and post high school intentions. More specifically, the study will address the extent of the policy's implementation as prescribed at the state level and North Carolina public school system level. Additionally, the study will describe the impact of the policy implementation on improving college math readiness, which will address the validity of the premise of increasing graduation requirements positively impacting community college math readiness. The study will also describe the potential impact of the policy on graduates' post high school intentions.

Purpose of Study

The purpose of this study was to examine high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions of Future Ready Core Graduates at the state and North Carolina public school system level. The study compared Future Ready Core graduates to graduates that completed the Year 2000 requirements prior to the implementation of Future Ready Core. The study examined high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions during the planning and implementation of the Future Ready Core requirements in North Carolina public school systems. Quantitative methodology was used to analyze high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions and determine

whether the Future Core Ready requirements resulted in an increase of completion of at least three or more college preparatory mathematic courses, average mathematic Scholastic Aptitude Test (SAT) scale scores, or shifts in graduates' post high school intentions.

Research Questions

In order to determine the impact of the Future Ready Core mathematics graduation requirements on high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions at the state level and North Carolina public school system level the following six questions were considered for this study.

1. To what extent did the proportion of students completing three or more college preparatory math courses change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
2. To what extent did the proportion of students completing three or more college preparatory math courses change among small, mid-size, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
3. To what extent did average Math SAT scores change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
4. To what extent did average Math SAT scores change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

5. To what extent did the proportion of graduates' post high school graduation intent plans change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
6. To what extent did the proportion of graduates' post high school graduation intent plans change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

Overview of Methodology

A quantitative methodology was used in this study to conduct an analysis of the impact of the Future Ready Core graduation requirements on high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions as compared to the previous high school graduating cohorts. The study utilized number of graduates completing three or more college preparatory mathematic courses; numbers of students reporting post high school intentions as four year college or community college; average math SAT scores; total number of high school graduates; the high school graduation year at the state and North Carolina public school system level.

Data Source

Data is recorded for all high school graduates from 2008 through 2013 from 115 North Carolina public school systems. The researcher's university Institutional Review Board (IRB) approval was gained through following the appropriate request at the institution. The researcher then accessed the data on the North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports from 2008 through 2013. North Carolina public school system size was determined by using United States Census county populations tables

according to the National Center for Education Statistics standards for small, mid-sized, and large.

Data Collection

High school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions data from North Carolina Department of Public webpages was recorded in Microsoft Excel. North Carolina public school system sizes were identified as "small", "mid-sized", or "large" according to counties reported Census population and recorded 0, 1, and 2 respectively for data analysis purposes. The other indicators for the state and each North Carolina public school system was recorded in accordance to information listed North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports from 2008 through 2013:

- The number of graduates who completed at least three college preparatory math courses as prescribed by the Future Ready requirements.
- The number of graduates who indicated on the post high school intent plans as four-year college or two year community college.
- The total number of high school graduates.
- The average mathematic SAT score for the school district.
- The high school graduation year was recorded as 2008, 2009, 2010, 2011, 2012 or 2013.
- The LEA number of the North Carolina public school district.

All student data was recorded in a Microsoft Excel file and transferred to Statistical Package for Social Sciences (SPSS) for data analysis.

Data Analysis

Due to the data source including the entire population of North Carolina public high school graduates, descriptive statistical methods were used to summarize the data instead of inferential statistics using SPSS. Categorical variables were summarized in frequency tables. Quantitative variables were summarized by means, range, and standard deviation for each graduation year. The categorical variables considered were year of graduation and the size of the school system. The quantitative variables considered were total number of high school graduates who completed at least three college preparatory mathematic courses completed; total number of high school graduates; average math SAT scale score of each school system; and number of graduates self-reporting the intent to enroll in four-year college or two-year community college. From this data the proportions of North Carolina public high school graduates completing three or more college preparatory courses and attending four-year college or two-year community college at of each district were computed for graduating classes between 2008 and 2013 graduates. For the purpose of this study, the practical statistical significance level was determined by a change of more than ten percentage points or SAT scale score points during the implementation of the policy.

Definition of Terms

The following terms and definitions are listed to develop a common language for the purpose of the research study:

College Readiness: A student who met the requirements to enroll in credit bearing college coursework (ACT, 2005; Aldeman, 1999; Conley, 2010).

Remedial Course: A college course that neither was credit bearing nor college level study (Aldeman, 1999).

Developmental Course: For the purpose of this study, a developmental course is the same as a remedial course (Aldeman, 1999).

Community College Math Placement Test: For the purpose this study, the national or locally selected assessment used by the community college to determine the student's math course placement.

College Preparatory Math Course: Mathematical core course defined as meeting the University of North Carolina System's admission requirements such as Algebra I, Algebra II, Geometry, Integrated Math I, integrated Math II, Integrated Math III, Advanced Function & Modeling, Pre-Calculus, and Calculus (UNC Policy Manual 700.1.1, 2008).

Future Ready Course math requirements: A college preparatory sequence as defined by the Future Ready Core High School graduation requirements excluding the substitution option. The sequence required the completion of Algebra I, Geometry, and Algebra II plus one advanced math course or Integrated Math I, integrated Math II, Integrated Math III, plus one advance math options. Advanced math options include courses such as Advanced Function & Modeling, Pre-Calculus, and Calculus (Graduation requirements, 16 NCAC 6D .0503 2009).

Graduate or high school graduate: A student who has met all graduation requirements and been awarded a high school diploma by an accredited high school.

Substitution or Technical Mathematics: A math course after Algebra I that does not meet the same curricular standards as Geometry or Algebra II, but meets North Carolina high school graduation requirements (Graduation requirements, 16 NCAC 6D .0503 2009).

Assessment or Placement tests: An assessment administered by individual college, independently of other colleges to determine readiness and opportunity to enroll for college level work (Aldeman, 2006; McFarland, 2006).

Significance of the Study

At four year universities, numerous studies have been completed that show a correlation between the academic intensity of a student's high school experience, to college readiness, aspirations and academic success (ACT, 2004; Aldeman, 2006; Attwell & Domina, 2008; Bartha, 2004; Norman et al., 2011). With an increasing amount of students requiring remediation courses within community colleges and universities, and the costs associated with offering these courses, there is a need to determine which course enrollment patterns tend to prepare students for college mathematics.

The results will provide data on the validity of the Future Ready Core graduation requirements policy's implementation and a comparison point to previously reported research findings of increased graduation requirements increasing mid-level or remedial high school coursework at state and size of school system level. Additionally, the results offer a comparison point of universal requirements as compared to multi-pathway graduation requirements in the area of student achievement in the form of average mathematic SAT scores. The findings also add to previously reported research of increased rigorous coursework positively effects on college readiness. The results will also provide potential context for the impact the Future Ready Core graduation requirements have on graduates post high school plans.

Professional Significance

The study's results will inform school leaders about the impact of the Future Ready Core mathematics graduation requirements on course enrollment, SAT math achievement, and graduates post high school intentions at the state and school system size levels. The findings of the study may assist school leaders in their continued implementation of the new Future Ready Core graduation requirements and Common Core Standards for Mathematics as part of the North

Carolina Accountability Reform Effort (NC ACRE) and Race to the Top grant initiatives (NCDPI, 2008; NCDPI, 2010; North Carolina State Board of Education, 2010). The Common Core Standards implementation occurred during the 2012-2013 school year and the first full high school cohort will complete all four courses in the spring of 2016 (NCDPI, 2011). Hence, the study of the graduation requirements and Common Core Standards' effect on high school mathematical course enrollment patterns, and college mathematics readiness, may serve as a repeatable and multi-step analysis of the ongoing North Carolina School reforms initiatives.

Assumptions

The following assumptions were considered when designing the study:

- The high school graduates in the study had a typical distribution of learning experiences and teacher competency throughout their high school careers.
- The participants in the study were permitted to self-select their respective high school mathematics curriculum pathway they completed for graduation.
- The participants who completed non Future Ready Core required math curriculum were provided instruction and grade level experiences as set forth by the North Carolina Standard Course of Study.

Limitations of the Study

The Future Ready Core Graduation requirements were adopted in 2008 for the high school class of 2013, which resulted in a four-year implementation process. Therefore, the high school graduating class of 2012 course math course enrollment patterns may have been indirectly impacted as schools prepared for the implementation of the first graduating class of Future Ready Core high school graduates in 2013. Additionally, the average SAT score database includes underclassmen.

Organization of the Dissertation

The study has been divided into five chapters. Chapter one serves as an introductory chapter and provides an overview of the study. Chapter two provides a context for the study through a review of the current literature. Methodology and procedures that have been used to conduct the study will be described in chapter three. Analyses of the results from the study are shared in chapter four. Chapter five will conclude with a summary and discussion of the findings, implications, and future potential research studies.

CHAPTER 2: LITERATURE REVIEW

Chapter two is presented to provide a context of the ongoing school reform movements, which have resulted in the adoption of the North Carolina Future Ready Core High School graduation requirements. The literature review is structured to provide a national level and a North Carolina perspective of influencing factors of the ongoing school reform efforts to ensure economic competitiveness. First, the literature review identifies ongoing concerns regarding mathematic education in American schools including international test results and underprepared high school graduates. Next, a national historical overview and analysis of the effects of national legislation, policies, and recommendations on the most common school reform recommendations such as increasing high school mathematics graduation requirements, student achievement, content standards, teacher competency, and college readiness are reviewed. Further, the North Carolina historical context and analysis of the effects of state legislation and polices are reviewed within the framework of aforementioned national school reform recommendations. In conclusion, the final section of the chapter identified and discussed gaps in research due to recently adoption and implementation of the Future Ready Core High School Graduation policy in North Carolina.

Concerns about Mathematic Education in American Public Schools

High school graduation rates traditionally served as an indicator to determine the success of public education; however, the value of a high school diploma has been often called into question (Strong American Schools, 2008). Researchers, policy groups, and politicians cited international achievement scores, loss of revenue due to an underprepared workforce, rising costs of remedial work force training and college remediation as reasons for concern. This section

discusses how United States students' performance on international mathematic assessments, and the reported costs of an underprepared high school graduates by policy watch groups.

A Comparison of American and International Mathematics Achievement

The Trends in International Mathematics and Science Study (TIMMS) assessment is administered by the International Association for the Evaluation of Educational Achievement. The TIMMS assessments measured students' overall proficiency as well as specific mathematics domains and provide rankings of each country's performance. The assessments included cognitive domain questions of knowing, applying and reasoning along with content domains in number sense, algebra, geometry, data and statistics. Additionally, the TIMMS reports' rankings are often used as preliminary economic indicators for future generations (International Study Center, 2011).

The United States has participated in TIMMS every four years since 1995. The assessments are administered to fourth and eighth graders. Over the past sixteen years, United States students' average scale scores improved steadily in TIMMS assessments. In fourth grade the average has always been above the international midpoint benchmark of 500 and has increased by 23 score points to 541 at the 2011 administration. In eighth grade the average scale points have increased above the international midpoint benchmark to 509 over the past sixteen years, which was a 17-point increase.

However, even with the increased average students' scale scores, the United States trailed eastern Asian countries at significant levels in fourth and eighth grades in TIMMS results (International Study Center, 2011). More specifically, in the 2011 fourth grade TIMMS results Korea, Hong Kong, Singapore, Chinese Taipei, Japan, Northern Ireland, and Belgium led the United States in average student scale scores and percent of students achieving advanced

international benchmark (International Study Center, 2011). In eighth grade, the United States trailed Korea, Singapore, Chinese Taipei, Hong Kong, Japan, and Russia Federation the 2011 average student scales scores (International Study Center, 2011). In the area of percent of students achieving above international benchmarks on TIMMS assessments, Chinese Taipei, Singapore, Korea, Hong Kong, Japan, Russian Federation, Israel, Australia, Hungary, and Turkey finished ahead of the United States (International Study Center, Figure 4, 2011).

The aforementioned countries who have consistently finished ahead of the United States are current economic competitors. The ongoing competition between United States students and eastern Asian counterparts presented the challenge of improving American students' mathematics skills to compete in an international economy (Schmidt, 2012). In addition to international competition, American college, universities, and business leaders have voiced concerns about mathematics preparedness.

Domestic Concerns of Mathematics Preparedness

The expense of college and workforce remediation, as well as lost revenue to international competition from an underprepared workforce created a financial hardship to the United States. Community colleges, universities, manufacturing industries, and researchers reported the need for increased remedial programs for high school graduates upon entering their programs (ACT, 2004; Conley, 2007; Greene & Winters, 2005; Strong American Schools, 2008; Wise, 2008). Achieve, Inc., and the National Governors Association (2005), as well as Strong American Schools Projects (2008) have projected respectively that 16 billion dollars and 2 billion dollars were lost annually in remediation or productivity from an underprepared work force. Therefore, community colleges, universities, and workforce decision makers have

provided high schools feedback and suggestions for improvement on ensuring high school graduates are prepared for post high school options.

High school course enrollment practices are misaligned with prerequisites for college courses. The Publication of Education Trust, A ticket to nowhere, using data from National Center for Education Statistics of 1997 indicated 70% of high school students surveyed expressed the desire to attend college, but only 50% have self-reported taking the appropriate coursework. Furthermore, enrollment in post-secondary institution within two years of high school graduation has neared 80% and remediation rates at the collegiate level increased dramatically during the same time period (Publication of Education Trust, 1999). Ten years later the United States was seventh and tenth respectively compared to world counterparts in 18 to 24 year old students attending college and 25 to 34 year old students completing at least an associate degree (National Center for Public Policy and Higher Education, 2008). In the span of ten years, the students completing necessary college programs of study to compete in a timely manner was still lagging behind international competition. Therefore, universities and community colleges have reached out for high schools to better align high school mathematics course requirements with college programs of study.

National Historical Context

This section provides a chronological historical context of high school graduations requirements that have influenced mathematics education.

Early Calls for Reform

School reform or structure has been discussed since the late 1800s. National Education Association (NEA) commissioned the Committee of Ten of college presidents, professors and secondary educators to analyze the issues with high school curricular programs due to the

increasing high school enrollment. The committee's recommendations included focused instruction on fewer high school subjects that would prepare students for mental activity; improved teacher preparation; college preparatory course enrollment patterns for all students specifically in mathematics until high school departure (Dexter, 1906; National Education Association, 1894). In 1918, Cardinal Principles of Secondary Education provided recommendations for reorganization of secondary education to include the larger "whole child" development with the recommendation of vocational exploration during junior high and specific vocation education during senior high years (Department of the Interior Bureau Education, 1928). The Cardinal Principles of Secondary Education's vocational education recommendations formed the multiple high school graduation requirement pathways such as college prep, vocational, and general (Mirel, 2006). The aforementioned studies have a common theme of improving education through organizational and curricular expectations; however, the two different perspectives fueled a debate on the organization and expectations for high school education including mathematics graduation requirements (Mirel, 2006).

Post World War II & Cold War Era

The status quo of different perspectives from the early reform movements remained static until after the Post World War II and early onset of the Cold War due to the country's mobilization of industry to support the United States' war efforts. Once the war ended, the country's focus was social reform, civil rights injustice and spread of democracy as a response to the rise of communistic governments (Steeves et al., 2009; Wishcher, Barrow, & Concannon, 2011). Public education served as the most common solution to address the aforementioned issues (Steeves et al., 2009).

The end of war also provided a chance for various entities to evaluate and offer solutions to address shortcomings in the area of mathematics education based on performance in an increasing technological world. According to the Center for the Study of Mathematics Curriculum (2004), the initial post war environment, military, industry, and National Council of Teachers of Mathematics (NCTM) raised concerns about soldiers and workers ability to consistently apply Algebraic principles. As a result the NCTM sponsored three different commissions to offer overarching proposals and recommendations to improve mathematics performance of all students (Center for the Study of Mathematics Curriculum, 2004). Another potential contributing factor to the underprepared mathematics military and workforce in the post war environment, universities were underfunded and understaffed due to faculty and resources being allocated to develop war time technology (Wischer et al., 2011). The aforementioned recommendations and concerns were discussed at state levels in a disorganized manner until 1957.

Sputnik Launch

In 1957 the Soviet Union launched Sputnik, the first satellite into space and the nation's priorities were quickly revised. The launch of Sputnik set forth a certain degree of anxiety, astonishment, and insecurity of the United States' ability to maintain technological superiority that provided victory in World War II and concern of the ability to win the Cold War versus the rising communist regimes (Steeves et al., 2009; Wischer et al., 2001). As a result of Sputnik, the United States increased financial and human capital into mathematics and science education to remain internationally competitive (Steeves et al., 2009). The National Education and Defense Act (NEDA) was enacted by Congress and President Eisenhower in 1958 to address shortcomings in the development of mathematics and science abled workforce to compete in the

technology based arms race (Wischer et al., 2001). According to Flattau et al. (2006), the NEDA had a financially supported four-prong focus:

1. Financial assistance for undergraduates pursing degrees in mathematics and science.
2. Additional budget allotments to the National Science Foundation to improve secondary mathematics and science instruction in public schools.
3. Fellowships to develop additional PhD graduate programs and increase number of students achieving PhD in the areas of science and mathematics.
4. Development of identification, placement, service and career guidance to students who show a strong ability in the areas of mathematics and science in secondary schools towards mathematics and science careers.

The United States response to Sputnik was the start of the Arms Race during the Cold War and rebuilding of a damaged national pride as well as the first national legislation aimed at school reform (Steeves et al., 2009). The additional college funds and resources resulted in the development of tracking systems for higher aptitude students and a breaking of the ice for national influence on education policy through financial incentive.

Politicization of School Reform

Throughout the 1980s and into the early 1990s, national policy groups and the United States government sponsored reports that raised concerns and offered recommendations for school reform for economic competitiveness. Based on the school reform recommendations, education reforms became a consistent political platform. The reports that will be discussed in this section include A Nation at Risk as well as National Council of Teachers of Mathematics'

An Agenda for Action in the 1980s and Curriculum and Evaluation Standards for School Mathematics in 1989.

A Nation at Risk. The National Commission on Excellence in Education was formed by United States Secretary of Education T. H. Bell and charged with the task of examining the state of education in the United States in 1981. In 1983, the National Commission on Excellence in Education published A Nation at Risk: The Imperative for Educational Reform which noted indicators of risk, findings, and recommendations to improve the nation's ability to remain internationally competitive as well as functioning as a civic minded society. The at risk factors included concerns in regards to the amount of 17 year old students who were considered functionally illiterate, the amount of college students and military recruits who required remediation, as well as the high percent of students who could not apply higher order thinking skills or write a persuasive essay effectively (National Commission on Excellence in Education, 1983).

The commission's findings were divided into content, expectations, time and teaching areas. A Nation at Risk described the quality of expectations for content, student academic performance, qualified teachers, and time spent on core subjects both in and out of the classroom as lower than our international competitors or previous generations of American students. Specifically in regards to content and student performance expectations, the report pointed out only 31% of high school graduates completed Algebra II and only 60% of high schools offer calculus as a course option which only 6% of high school graduates completed. As per teacher qualifications, the commission reported half of new math teachers were unqualified. Based on at risk indicators and findings, the commission provided four recommendations:

1. Increase high school graduation requirements to include 3 years of math, science, social studies and 4 years of English for all students as well as 2 years of foreign language for college bound students.
2. Adopt higher academic standards.
3. Increase the length of school day to 7 hours and school year to 200 school days.
4. Increase the length of the teacher's calendar to 11 months to improve competency and compensation.

As a result of A Nation at Risk report in 1983, the issue of increasing high school graduation rates and the quality of the graduates resurfaced and became an ongoing initiative in political and policy discussions (Bracey, 2009). According to Bracey (2009), the A Nation at Risk report itself was more of a political agenda. He suggested the Sandia Report, which dissented with A Nation at Risk's data sources and findings, was buried under peer review for four years by key United States education cabinet members.

Regardless of the political or statistical basis of the findings, national policy makers and school reform groups during the 1990s and early 2000s continued the school reform movement through setting or recommending higher standards for student achievement, graduation requirements, and teacher qualifications in alignment of with A Nation at Risk's recommendations.

National Council of Teachers of Mathematics. The National Council of Teachers of Mathematics (NCTM) was the first organization that focused on developing standards for high quality mathematics education. The NCTM is an organization whose sole purpose since the 1920s has been to advocate as a public voice for quality mathematic education. The NCTM's foundational priorities included access and equity; advocacy; curriculum, instruction, and

assessment; professional development; research; and technology (NCTM, 2012). This national association provided framework and guidance for states to develop rigorous mathematics curricula and for high school graduates to be prepared for workforce, college and international competitiveness. Over the past thirty years, the process has had three major phases: An Agenda for Action in the 1980s; Curriculum and Evaluation Standards for School Mathematics in 1989; and Principles and Standards for School Mathematics in 2000 (Center for the Study of Mathematics Curriculum, 2004). The next paragraph addresses the NCTM's contributions during the 1980s and the 2000 contributions will be addressed later in the national historical context section.

During the 1980s the NCTM proposed An Agenda for Action in response to performance gaps on various national and international assessments (NCTM, 1980). In An Agenda for Action, eight overarching recommendations and 52 sub-recommended actions were provided to improve mathematics education. The overarching recommendations included:

- Focus on problem solving in all areas of mathematics.
- Expand arithmetic beyond basic computations.
- Implement calculators and computers to their fullest potential at all grade levels.
- Raise standards for effectiveness and efficiency of instruction of mathematics.
- Expand measures of student learning beyond conventional testing.
- Increase mathematics study for all students with the flexibility in course options.
- Increase expectation of professionalism and competency of mathematics teachers.
- Increase awareness and public support for mathematics education.

As a result of the aforementioned recommendations, a commission was established by NCTM to propose a document that would outline a vision for mathematical literacy and a

standard guide to create a mathematics curriculum at the state and district levels. The commission outlined new goals for a mathematics literate society and student learning in the publication of Curriculum and Evaluation Standards for School Mathematics in 1989. The standards were organized in grade bands such as K-4, 5-8, and 9-12 with a focus on shifting from computation mathematics to a more rigorous conceptual mathematics that emphasized problem solving as well mathematics reasoning and communication. Additionally, the 1989 released standards recommended all four years of mathematics at the high school level for all students (Center for the Study of Mathematics Curriculum, 2004).

Due to the NCTM newly developed standards, additional funding became available and mathematics public education practices started to shift. According to the Center for the Study of Mathematics Curriculum (2004), the National Science Foundation funded several mathematic curricular and assessment based initiatives. In addition, mathematics education also experienced integrations of graphic calculator and other technology devices; professional development in mathematics education; K-12 statistical software for mathematics education; and a shift of instructional practices to inquiry or problem based as a result of Curriculum and Evaluation Standards for School Mathematics release in 1989. In effect, policies and practices started to shift to include necessary skills for post high school readiness in workforce, college readiness and global competition.

Direct Federal Government Influence in Response to Globalization

As a result of the reports and recommendations in the 1980s and concerns of international competition of a technology driven global environment, the federal government enacted several legislations to influence school reforms during the 1990s to present day. Additionally, the NCTM continued to provide recommendations, which influenced mathematic curriculum

development. This section will address "Goal 2000: Education America Act", NCTM released Principles and Standards for School Mathematics, No Child Left Behind, Race to Top grants and Common Core Standards.

Goal 2000: Educate America Act. In 1994, "Goal 2000: Educate America Act" legislation was passed by the United States Congress and signed into law by President Clinton. The legislation set national goals similar to A Nation Risk Recommendation in improving teacher education and professional development, math and science content knowledge as well as problem solving and writing skills. The legislation added graduation rate and student achievement goals for the year of 2000 with limited federal funding (P.L. 103-227).

National Council of Teachers of Mathematics. In 2000 the NCTM released Principles and Standards for School Mathematics to renew the focus on mathematics education with specific focus on realignment of pre-k through 12th grade standards for a changing economy, additional teacher resource, framework for state curriculum development, and a conversation stimulate (NCTM, 2000). NCTM recommended six principles for mathematics curriculum development included equity of high expectations for all students; coherent curriculum, effective teaching practices, conceptual student learning based on problem solving, informative assessments, and appropriate use of technology to support mathematics conceptual understanding. In the 2000 release of the standards, the National Council of Teachers of Mathematics divided the standards into two groups: content and process. The content standards included numbers and operations, algebra, geometry, measurement, and data analysis and probability. Process standards included problem solving, reasoning and proof, communication, connections, and representation (NCTM). In similar fashion to the 1989 standards, the NCTM also recommended in the 2000 report high school mathematic courses to have less differentiation

and for all students to have a rigorous course of study of four years of mathematics in high school (Center for the Study of Mathematics Curriculum, 2004; NCTM, 2000).

All three reports released by the National Council of Teachers of Mathematics over the past thirty years were purposefully written to serve as a guide and catalyst for conversation and change as states and districts formed their curricula.

No Child Left Behind. The adoption of No Child Left Behind (NCLB) legislation in 2001 focused on creating a blueprint for school reform. The legislation included requirements similar to A Nation at Risk recommendations by requiring teacher qualifications in core areas (White House, 2001). NCLB also expanded the recommendations by requiring states to set adequate yearly progress (AYP) goals for student achievement by subgroups such as ethnicity, free-reduced lunch, and limited English proficiency, for all students to be performing at grade level by 2014, overall goals for student attendance, and four year graduation rates (White House, 2001). The federal legislation also required states' to create plans to include sanction and intervention plans of schools and providing parent opt out provisions for students in schools which do not meet AYP goals (White House, 2001).

Race to Top Grants and common core standards. As part of the American Recovery and Reinvestment Act of 2009, the federal government offered competitive Race to Top (RtT) Grants to stimulate systematic school reform initiatives at the state levels. The grant applications were assessed on the following criteria: rigorous curriculum standards and assessments, data systems to support instruction, supports to develop great teachers and leaders, plans to turn around the lowest-achieving schools, and state success factors (U.S. Department of Education, 2009).

During the same time period of the RtT Grant application process, Common Core Standards were developed by the Council of Chief State School Officers and National Governors Association Center in 2010 to create national college and career readiness standards (Common Core State Standards Initiative, 2010). The RtT rubric included specifics language for adopting high academic standards that were part of a consortium and measuring student achievement in terms of college readiness (U.S. Department of Education, 2009)

College Readiness

Throughout literature, college readiness was generally defined as the student's ability to meet the requirements to enroll and succeed in credit bearing college coursework as per the institution's requirements or organizational benchmark standards (ACT 2004; ACT, 2005; ACT 2012; Aldeman, 1999; Conley, 2010; U.S. Department of Education, 1996). Students who are underprepared to meet college bearing coursework requirements are required to take remedial coursework to supplement the skills and knowledge that should have been learned in high school. However, defining college readiness was where consensus agreement ended among the researchers.

Measuring the current state of college readiness among students entering college was difficult due to the varying methods and language used by the institutions. Students, colleges, researchers, and reform groups have a certain degree of variance in assessment methods as well as respective reported perceptions and research based findings involving the characteristics around college readiness (Merisotis & Phipps, 2000; McFarland, 2006). Each college or reporting organization determined their own standards and assessment method to meet the requirement of college bearing courses (McFarland, 2006; Publication of the Education Trust, 1999; U.S. Department of Education, 1996). McFarland also pointed out some colleges have

different placement standards for college readiness within their own school based on the student's academic program. Therefore, due to the variance in the each school's respective system, it was difficult to streamline conversations on college readiness.

Additionally, college placement assessments are commonly used to supplement high school transcripts for college readiness placement. For example, college assessment methods included college placement tests, ACT or SAT, high school grade point average or high school transcript requirements. Seventy percent of two-year community colleges required math placement assessments regardless of a student's history and 26% of the other community colleges only required college placement assessment if the student does not meet one of the aforementioned methods (U.S. Department of Education, 1996).

Effects of National Policy

Increasing high school graduation requirements, student achievement, content standards, teacher competency, and college readiness were the pillars of the school reform strategies that have been recommended or legislated in the aforementioned national policies and recommendations. This section discusses the outcomes of the reform strategies outlined in the national policies. Table 1 provides a visual summary of the relationships between the policies and reform strategies.

Increasing High School Graduation Requirements

Increasing high school graduation requirements at the national level was a recurring recommendation; however, implementation of the recommendations was applied differently at the state levels. As a result of A Nation at Risk in 1983, high school graduation requirements in general were increased across most states (Chaney et al., 1997; Clune, 1989; Clune & White, 1992; Lillard & DeCicca 2001; Teiteblaum, 2003). Clune reported 41 states revised

Table 1

School Reform Policy & Publication Summary

Policy or Publication	Increase Graduation Requirements	Increase Content Standards	Increase Student Achievement	Increase Teacher Competency	Increase College Readiness
Committee of Ten	X	X		X	
A Nation at Risk	X	X		X	
NCTM Standards ('89) & ('00)	X	X	X		
Goal 2000		X	X	X	
No Child Left Behind			X	X	
Race to Top Grant		X	X		X

their high school graduations requirements by 1984. According to Reyes, Dingman, Nevels, and Teuscher (2007), most of the states' requirements revisions in the 1980s and present ongoing policy revisions have a fairly large amount of variance in quantity and types of course selection. As of 2004, Planty and Provasnik reported only 23 states met the National Commission on Excellence in Education's recommendation of three math and science courses.

The rationale and evidence of increasing high school graduation requirements were based on mostly assumptions and cost effective options. When policymakers initially responded to the National Commission on Excellence in Education increasing high school graduation requirements recommendations, there was little research or empirical evidence present to support the policy changes (Clune & White, 1992; Sebring, 1987; Stedman & Smith, 1983). Policy makers chose to increase high school graduation requirements under the assumption that additional core classes would correlate to an increase in student achievement and post-secondary preparation (Clune & White, 1992; Schiller & Muller, 2003; Sebring, 1987). Additionally, Chaney et al. (1997) also pointed out that increasing graduation requirements was more cost efficient when compared to the other recommendations offered by the A Nation at Risk Report.

Increase of high school course taking. The research studies involving increased high school graduation requirements typically focused on course taking patterns. According to Clune (1989) and Sebring (1987), students were taking additional core classes as a result of the increased graduation requirements. More specifically, Stevenson and Schiller, using data from the National Longitudinal Study of Schools, reported that core subject courses increased 1.6 courses between 1980 and 1993 (Publication of Education Trust, 1999). However, the increase in core course taking was misleading due to the increased earned courses being in reality an increase of remedial or mid-level courses taken at the beginning of the college preparatory

sequence (Clune & White, 1992). The disconnect between the number and level of courses taken as a result of an increase high school graduation requirement was most likely due to the ambiguity in the course type and various tracks within the new graduation requirements (Publication of Education Trust, 1999; Sebring, 1987). The disconnect between course-taking and college preparatory classes resulted in underprepared graduates who are unprepared for internationally competitive job markets.

High school course selection patterns. Potential factors that led to this disconnect of increased course enrollment with college preparatory classes is multifaceted. Research has typically been centered on variables such as ethnicity, social economic status, pre-high school performance, student aspirations, curriculum tracking, and school scheduling practices (Conley 2010; Gamoran, 1992; Kelly, 2007; Schiller & Muller, 2003). The next paragraphs describe the previously mentioned variables.

The ethnic course enrollment patterns in more rigorous courses required a more in-depth assessment that simple descriptive analysis. Balloon in 2008, when studying potential racial biases in math tracking assignments, pointed out at first glance of the descriptive data that minority students appear to be underrepresented in more college preparatory courses. However when prior academic performance was accounted for in their study using a linear regression model, ethnic groups with the exception of Hispanic students are over represented in the more college preparatory courses. Attwell and Domina (2008) had similar findings as Balloon per ethnic group representations in college preparatory courses once prior academic performance was consider; they also had similar findings for low socio-economic students. Schiller and Muller (2003) found in their study a small but significant negative difference in the variations of course selections and level of rigor of courses as per ethnicity and socioeconomic factors

according to the state required graduation requirements using National Education Longitudinal Study of 1988-1992 data; but they did not account for prior student academic performance. Even though in the larger picture, the minority students who have qualified for college preparatory tracks completed it; the contributing factors such as prior academic performance and student aspirations that place the student into the high school college preparatory tracks are not specifically relevant to this study.

Curriculum intensity. Increasing curriculum intensity has been an ongoing process since the release of A Nation at Risk in 1983 and the commission's recommendation of three rigorous math courses in high school graduation requirements. According to U.S. Department of Education (2010), Algebra II enrollment increased to 67% by 2000. Planty and Provasnik (2007) also reported student enrollment in advanced math past Algebra II has increased to 50% in 2004 from 26% in 1983.

Even with the successes of increasing course enrollment to the recommendations of A Nation at Risk, policymakers and researchers are suggesting the standards need to be increased again. ACT (2004), Corbishley and Truxas (2010), Strong American Schools (2008), Wise (2008) recommended increasing requirements to include four math courses one of which would be past Algebra II for all high school graduates. ACT's findings in 2012 supported the aforementioned recommendation when they reported a 2.6 to 3 point difference in course-taking patterns of students who were below the recommended core compared to those who met or exceeded the A Nation at Risk's (1983) math recommendations. ACT also reported a larger discrepancy for students who exceeded the core recommendations.

Effect on student achievement. Since increasing high school requirements were the only consistent recommendation implemented due to cost efficiency and state level policy

(Chaney et al., 1997). Student achievement can be most effectively measured through studying the academic impact of increasing graduation requirements. The impact of increasing graduation requirements on student achievement is a multi-leveled discussion due to the variance in students' course taking patterns to meet the high school graduating requirements. When examined at the whole group level, increasing graduation requirements in literature has generally had marginal to no significance or in some cases negative effect on student achievement (Allenworth, Nomi, Montgomery, & Lee, 2009; Clune & White, 1992; Lillard & DeCicca, 2001; Teiteblbaum, 2003). However, the research did show positive correlations for students completing the more rigorous course work (Chaney et al., 1997; Lee & Burkam, 2003; Lee, Robert, & Smith, 1997). Thus for the purpose of this section, the effect of increasing graduation requirements on student achievement has focused on correlations between graduation or dropout rates and students who have taken the recommended more rigorous graduation requirements of three math course requirements.

Impact on graduation and drop-out rates. The effects of increasing high school graduation requirements on dropout or on-time graduation rates are mixed. Chaney et al. (1997) and Lillard and DeCicca (2001) have reported a negative association between increased graduation requirements (types of courses) and a reduction of on time graduation rates, especially with at risk students. They argued the increased course work was often seen as too large of a challenge. Allensworth et al. (2009) conducted a 10 year time-series cohort study of Chicago Public School's college preparatory requirements for all students in which they partially agreed with potential negative consequences of increased graduation requirements. Their study concluded that students with lower academic abilities had significantly increased failure rates,

but found no significant difference in graduation rates. They also noted college attendance and test scores did not increase as a result of the more rigorous policy.

Susan Black's (2003) findings contradicted Lillard and Decicca's (2001) findings that increased graduation requirements increases high school dropout rates. Black proposed that often students who are not challenged dropout. Lee and Burkam's (2003) empirical study of dropout rates as per curriculum constraints supported Black's findings at the school level. A level curriculum constraint was computed by assessing the number of higher math courses above Algebra II such as trigonometry or calculus as compared to the number of remedial math courses taken below Algebra I. The aforementioned study of 10th through 12th grade students of randomly selected high schools found the school systems who had a more constrained curriculum (less remedial math courses) had lower dropout rates.

At the student level, students who have taken more rigorous courses have had positive correlations in tests scores and post-high school readiness (Adelman, 1999; Chaney et al., 1997; Lee et al., 1997; Teitelbaum, 2003; Warburton et al., 2001). Considering Lillard and Decicca's (2001) concerns of students not being able to reach the standards of higher level courses, Chaney et al. (1997), reported that students who did not pass the more rigorous classes had positive significant increases in their National Assessment of Educational Progress (NAEP) scores. Both advocates and opponents of increasing high school graduation requirements have had similar findings at the student level of increase rigorous coursework positively impacting assessment achievement data.

Higher academic standards. As of 2010, 45 states, 4 territories, and Washington DC have adopted the Common Core standards for Mathematics and Language Arts; thus creating more rigorous course expectations as recommended by the National Commission on Excellence

in Education in 1983 and National Council of Teachers of Mathematics throughout the 1980s and 1990s (Common Core State Standards Initiative, 2010). However less than four years later, several states have or are in the process of repealing or renaming the Common Core Standards due to concerns over federal oversight into state education policies (Bidwell, 2014).

Teacher quality. The Committee of Ten, A Nation at Risk, Goal 2000, and No Child Left Behind, all proposed increasing teacher quality; however, only No Child Left Behind was the only legislation that had financial implications to comply with the legislation (Education Commission on Excellence in Education, 1983; National Education Association, 1894; P.L. 103-227; White House, 2001). According to Jennings and Stark-Renter's (2006) findings from a four year data collection sample at the Center on Education Policy, the percentage of highly qualified teachers have increased in core areas of the surveyed districts to 88% after No Child Left Behind implementation.

Current state of college remediation. The amounts of students who need college remediation or did not meet college ready standards are too high; however, the exact numbers varied per institution or reporting agency. ACT (2012) reported that 28% of all test takers did not meet any of the four college ready benchmark standards as compared to 25% who met all four. ACT composite scores have been at a four year plateau of 21.0 (U.S. Department of Education, 2010) which is one point lower than the college readiness average of the four subject area composites. Planty and Provasnik (2007) reported a keen observation in regards to the low number of students meeting the ACT college ready standards that with the exception of five states, the students elected to take the ACT assessment possess college aspirations. Hence, the numbers not meeting any of the college ready benchmark standards are most alarming.

Public two-year colleges have experienced similar alarming patterns in college remediation enrollment. According to Parsad and Lewis (2003), students meeting the college readiness standards at public two-year college remediation rates in math, reading, or writing of incoming freshmen in 2000 were 42%. The high community college remediation rates can be attributed to the open access enrollment policies and increasing enrollment as a result of a shifting workforce (McCabe & Day, 1999; Rosenbaum & Person, 2003). Hence, the higher community college remediation rates average has been reported between 50 and 54% over the past twenty years by various researchers (Adelman, 1999; McCabe & Day, 1999).

Consequences of college remediation. Costs of college remediation are often cited as consequence by researchers, policy, and politicians. For example, Achieve, Inc., and National Governors Association (2005) and Strong American Schools Projects (2008) have projected respectively that 16 billion dollars and 2 billion dollars were lost annually in remediation or productivity from an underprepared work force. However, the amount and actual cost was unclear. Several researchers did pose the thought of actual amount and cost of college remediation being under or over reported due to inconsistent standards, assessments, course titles, image concerns for students or public in general, or miscalculating direct or indirect costs that vary by institution (McCabe & Day, 1998; Merisotis & Phipps, 2000; Rosenbaum & Person, 2003; Saxon & Boylan, 2001). Meristotis and Phipps also provided a unique perspective of the different previously mentioned high costs of college remediation, as one billion dollars would be less than one percent of the entire education budget. Additionally, the percent of students of college remediation class does not actually reflect the amount of recent high school graduates who are actually taking college remedial classes since the numbers include nontraditional students (Meristosis & Phipps, 2000). Therefore the consequences of college remediation are

monetary as well as a stigma on students; however it was hard to pinpoint the exact cost due to the lack of common language among colleges and complexity of funding formulas.

Potential causes and solutions to college remediation. The lack of college readiness or need for college remediation was multifaceted. The blame shared by colleges, high schools, and students (Publication of the Education Trust, 1999). High school graduation requirements often do not meet the expectations for college admissions or college readiness skills (Green & Forster, 2003; Green & Winters, 2005; Sommerville & Yi, 2002). Furthermore, high school standardized testing, college placement assessments and college admission standards often did not align in content, style, or performance expectations (Latterell & Frauenholtz, 2007; Publication of the Education Trust, 1999). Thus, colleges are knowingly admitting students who are not prepared for college credit bearing coursework (Publication of Education Trust, 1999).

Another contributing factor to the high college remediation placement rates may be the assessment method for college readiness. Belfield and Crosta (2012) found that the high school un-weighted grade point average was a more effective indicator for college success than college assessment testing. A primary conclusion was college assessments only measure content and did not account for students' motivation and study habits like high school grade point averages (Bastian, 2012; Belfield & Crosta, 2012).

Perceptions and understanding of expectations of the process to qualify for college bearing coursework also could have been factoring into the issue. Incoming freshmen may have not always understood the role of placement tests or taken them seriously (Latterell & Frauenholtz, 2007). There was also a discrepancy in high school and college's faculty perceptions of college readiness, ACT's 2009 survey that included the question "if students were prepared for college content by high school course work or high school graduation requirements"

respectively 60 and 50% discrepancy gaps were noted between the two respective groups. Regardless of the disparity in perceptions of high school and college faculties or requirements between high schools and colleges, increasing high school coursework's intensity has shown positive correlations at significant levels for students qualifying at college ready level (Attwell & Domina, 2008; Aldeman, 2006; Bartha, 2004; Norman et al., 2011). However, Attwell and Domina's study using National Educational Longitudinal Study data from 1988 and a regression model did show a more modest significant level than other researchers or policy groups have claimed.

Impact of math course selection patterns. Course and graduation pathway options and selection patterns impact the need for college remediation. According to Achieve (2004), a disconnect exists between high school math course selection and post high school plans. More specifically, Achieve reports 30% of students are taking coursework necessary for college or post-secondary readiness, but 70% will enroll in a college or other post-secondary opportunities. Achieve's concerns are most likely attributed to the various tracks or lack of defined coursework within the new graduation requirements listed in Sebring (1987) and along with other research studies such as Clune and White (1992), Publication of Education Trust (1999) and Teiteblbaum (2003).

At the student level, the rigor of the student's coursework has served as strong indicator of the student's post-secondary success. Adelman reported the strength of the high school curriculum pathway accounts for 40% of a predictive academic background indicator to forecast bachelor's degree attainment. Additionally, Warburton et al.'s study showed a positive correlating relationship of increased high school rigorous coursework to college grade point average and an inverse relationship of increased high school rigorous coursework to remedial

college coursework enrollment. As per math pathways, students who enrolled in four years of high school math which exceeds the National Commission on Excellence in Education's recommendations in 1983 and aligned with Corbishley and Truxas (2010) recommendation of Algebra II plus one advanced math class had a significant influence in completing collegiate degrees with limited need for college remedial coursework (Adelman, 1999; Aldeman, 2006; Anderson & Post, 2011; Norman, Medhanie, & Harwell, 2011; Strong American Schools Project, 2008).

Evolvement of North Carolina Policies

In the subsequent timeline sections of the literature review, the evolvement of the national policies and recommendations impact on North Carolina public education. The accountability movement as well as recent graduation policy revisions and education reform initiatives are discussed in next section.

ABC Accountability Model

In 1995, the North Carolina General Assembly provided a similar directive to the Goal 2000: "Educate America Act" legislation to the North Carolina State Board of Education (NC SBE). NC GS 115C-105.20 or School-Based Management and Accountability Program required the NC SBE to develop a restructuring and accountability plan to improve student learning through a system of recognitions and interventions. According to the Blue Ribbon Commission on Testing and Accountability (2008), the NC SBE proposed the North Carolina ABCs system of accountability which used growth and overall student performance composite on state developed end of grade tests to determine appropriate recognition and intervention schools. The proposal was approved by the North Carolina General Assembly in 1996 and was implemented in grades kindergarten through eight statewide in 1997. The high school model included standardized

testing, drop-out rates, and percent of graduates who complete college prep/college tech graduation requirements and was implemented in 1998 (Blue Ribbon Commission on Testing and Accountability, 2008). The ABC accountability model was used for the next 15 years to measure school performance.

Response to No Child Left Behind

In the context of North Carolina, the North Carolina State Board of Education (NCSBE) chose to use the NC ABCs' end of grade and end of course assessments to monitor student achievement for each subgroup and added a four year cohort graduation rate to comply with the NCLB requirements starting in 2004 (Blue Ribbon Commission on Testing and Accountability, 2008; Policy delineating the components of the ABCs Accountability Program including Adequate Yearly Progress, GCS-C-020, 2012). NCLB did not specifically impact mathematics course taking patterns or focus on college readiness. However, NCLB did put a focus on data and making school performance more public.

The North Carolina ABC Accountability and NCLB policies reframed the educational focus to student achievement at the school level through incentive and punitive measures. The next section has focused on the evolvement of North Carolina High School graduation requirements and its impact on college readiness.

North Carolina High School Graduation Requirements

North Carolina high school graduation requirements followed the national trends of a long static periods followed by a slow starting progression of increasing standards over a thirty year period to improve college and workforce readiness of high school graduates. For example high school graduation requirements were unchanged from 1953-1982 in which a student needed to complete sixteen courses to graduate according to a press release by the North Carolina

Department of Instruction (NCDPI) in March 2001. In 1983 the requirements were increased to eighteen courses, which included an increase of one math and elective credit respectively. Unfortunately, no press releases from the NCDPI were located to identify the exact reasons for the changes. However, the revisions to the policy aligned with the general recommendations and timeliness of the A Nation at Risk, and Chaney et al.'s (1997) findings of research at the national level as well NCTM's recommendations. The next policy change was reported in year 2000.

Year 2000 graduation requirements. The slow progression of increasing the rigor of high school graduation requirements started to accelerate towards the vision of post high school readiness at the start of the 21st century. The NC SBE increased the graduation requirements in the year 2000 to twenty courses and selected from four preparatory pathways such as career, career tech, university or occupational according to their post high school plans (NCDPI, 2001). The primary differences in the first three mentioned preparatory pathways are at the level of mathematics and if an elective career specialization or foreign language was required. More specifically, career preparatory pathway required completion of Algebra I; career tech preparatory pathway required completion of Tech Math II; and University preparatory pathway required completion of Algebra II and two foreign languages. The fourth pathway was designed for students with special needs. Occupational preparatory pathway required special education math courses.

The North Carolina Department of Public of Instruction (NCDPI, 2001) press release outlining the different pathways within the new graduation requirements outlined the need for students to consider future goals as planning high school coursework. The change in graduation requirements policy with a focus on career or college goal emphasis could be heavily attributed to the North Carolina economy, increased college enrollment, and public criticism of disconnect

between public school and post high school needs. The labor market observed a dramatic shift in the need for additional training or education (McCabe & Day, 1998; Rosenbaum & Person, 2003). According to Quinterno (2008), the North Carolina job market growth outpaced the workforce's capability due to decreasing in agriculture industry and increase in technology job market. Several educational reports such as Prisoners of Time (Education Commission of the States, 1994) called for changes in high school course requirements and methods of instruction to compete in the 21st century global economy.

Future Ready Core graduation requirements. The full transformation of high school graduation requirements to universally prepare all graduates for college or workforce entry with the same requirements occurred with the adoption of the Future Ready Core graduation requirements. In September of 2008, the North Carolina State Board of Education (NC SBE) revised the graduation requirement policy into the Future Core Ready (Graduation requirements, 16 NCAC 6D .0503 2009) for students who enrolled in ninth grade in the fall of 2009 and would graduate in 2013. The policy stated all students are required to complete four math courses including Algebra II or Integrated Math III plus one advanced math option with a limited opt out or substitution option.

Accountability Curriculum Reform Effort (ACRE)

In conjunction with increasing the high school graduation requirements to increase college and career readiness of North Carolina graduation, the state started evaluating and making plans for improvement of all aspects of North Carolina public education. The NC SBE commissioned the Blue Ribbon Commission on Testing and Accountability in 2007 to conduct a thorough examination of the assessment system in North Carolina. The commission provided recommendations for the current assessment system and planning of future accountability

systems to the NC SBE in January of 2008, (Blue Ribbon Commission on Testing and Accountability, 2008). The cornerstones of the recommendations included a moratorium on the development of new curriculum and assessments, comprehensive design and alignment of new curriculum and assessments, and development of an accountability system that included a provision of graduates who have met college ready standards through college placement or advancement placement classes (Blue Ribbon Commission on Testing and Accountability, 2008).

As a result of the Blue Ribbon Commission Report, the NC SBE developed a Framework for Change in June 2008 and required the NCDPI to prepare a response or plan of action by October 2008 to implement the 27 comprehensive reform efforts and current system recommendations (NCDPI, 2008; NC SBE, 2008). As a result of the findings, recommendations, and responses of the aforementioned three groups, the Accountability and Curriculum Revision Effort (ACRE) initiative was born to revise all curriculums, assessments, professional development, and accountably systems over a five-year period (NCDPI, 2011).

In 2010, North Carolina was awarded federal government Race to the Top grant monies as part of the American Reinvestment Recovery Act to enact systematic innovative school reform initiatives to increase academic standards including college readiness indicators, accountability for teachers and administrators, and adopting federally approved plans for turning around lowest achieving schools (NCDPI, 2010). The Race to the Top grant monies were used to accelerate the ACRE initiatives to improve public education in North Carolina.

College Readiness

North Carolina Community Colleges have traditionally determined college readiness in a similar fashion to the national trends outlined in early sections; however, they are revisiting and expanding the systems. North Carolina Community Colleges have traditionally used student-standardized assessments with defined cut scores to determine college readiness (Liston, 2012). However, the North Carolina State Board Community College System (NCSBCC) has recently adopted a multiple measure placement system that includes a tiered system that considers un-weighted high school grade point average of 2.6 as a primary indicator of college readiness followed by ACT, SAT, and then state developed subject specific assessments. The aforementioned policy approved revision's timeline for implementation will occur within the next three years, which will be decided by each individual community college (NCSBCC, 2013).

Effects of North Carolina Policies

The purpose of this section was to examine the effects of the previously outlined state policies that were parallel to national policies and recommendations to impact school reform on high school graduation requirements, academic standards and college readiness.

Graduation Requirements Evolution

During the 1983 to 1996 graduation revisions, the North Carolina State Board of Education (NCSBE) started to address through policy the concept of raising academic expectations through graduation requirements and developing a post-high school planning process as recommended in A Nation at Risk and National Council of Teacher of Mathematics (NCTM). However, the policies did not address the needs of appropriate, rigorous coursework to meet post high school opportunities for all students. For example, North Carolina did not

require Algebra I as a high school graduation requirement until the 1996 graduating class (NCDPI, 2001).

Year 2000 multi-track graduation requirements. The year 2000 revisions of North Carolina graduation requirements university prep pathway was the first such requirements to meet the A Nation at Risk in 1983 and NCTM throughout the 1980s and 1990s recommended graduation requirements in North Carolina (NCDPI, 2001). As per the actual selection of high school courses and graduation pathways, Kelly (2007) studied how school level policies and practices influenced student's high school course sequence in North Carolina graduation requirements which required the students to select a pathway such as career prep, career tech prep, university prep, or occupational prep course of study. According to Kelly, the less rigorous graduation pathways are often student self-selected during their eighth grade year as per student – parent informed elective option. Kelly speculated this may be a result of students desiring vocational lab based courses or an effort to avoid summer reading assignments.

Prior academic performance may have also influenced school decision-makers placement procedures as well. Counselors or faculty placed students in the lower pathways by scheduling lower math sequences and core subject classes during a student's freshman and sophomore years due to not having required prerequisite school or district determined test scores or course grades for the more rigorous courses (Kelly, 2007). Students and parents did not typically discuss or endeavor to change their course offerings due to compliance nature of earning high school diploma (Conley, 2010). After course sequences were started by electively or placement, it was difficult for students to change tracks as a result of the significant level difference in the coursework and expectations (Gamoran, 1992; Kelly, 2007).

Future Ready Core graduation requirements. The recently adopted Future Ready Core high school graduation requirements aligned with the recommendation of Corbishley and Truxas (2010) of exceeding A Nation at Risk of four college prep math courses. The more uniform rigorous courses requirements corresponded with the positive correlations in tests scores and post-high school readiness of recent research studies (Adelman, 1999; ACT, 2012; Chaney et al., 1997; Lee et al., 1997; Teitelbaum, 2003; Warburton et al., 2001).

Increasing Academic Standards (Common Core)

The Detailed Scope of Work or application for the Race to Top grant included many of the ACRE initiatives and added adopting the Common Core Standards for Mathematics which were created by the National Governors Association Center for Best Practices and Council of Chief State School Official to increase college and career readiness (NC SBE, 2010). According to Achieve Inc., the Common Core Standards for Mathematics are aligned in content to NCTM's recommendations set forth in both the Standards for School Mathematics and Focal Points released in 2006 (Achieve, 2010). As a result of receiving the grant and NC ACRE initiatives, new curriculum standards in all subjects and assessments for math, reading, and science were implemented during the 2012-2013 school year (NCDPI, 2011). The bird's eye view of the policies revisions and timeline implementation in North Carolina consists of the Future Ready Core Graduation Requirement, increased academic standards, more rigorous assessments, and a more comprehensive accountability system all intersecting in June of 2013.

College Readiness

In the context of North Carolina, college readiness concerns mirrored national reports due to the amount and the cost of developmental education courses of high school graduates. Specifically, Linson (2012) reported to the NC SBCCCS that 69% of entering students enrolled

in remedial courses during the 2011-2012 academic year. According to Bill Schneider, Associate Vice President of Research and Performance Management of the North Carolina Community College System, the cost of community college remediation in North Carolina during the 2012-2013 academic year was 105 million dollars of which 57 million dollars was funded from the state (B. Schneider, personal communication, January 8, 2014). Dr. Schneider also shared similar concerns to national research in calculating the exact cost of remediation due to indirect support costs; hence, the state's reimbursement rates are used for calculations.

Research Gap in the Context of North Carolina

With the North Carolina State Board of Education adoption of the Common Core Standards in June of 2010 as well as Future Core Ready Graduation Requirements in September of 2008 and implementation of both occurring in the 2012-2013 school year, North Carolina has increased both graduation requirements and academic standards as suggested in A Nation at Risk and recommended by the NCTM over the past thirty years. This research has attempted to provide an analysis of the impact of the recently increased graduation requirements on high school mathematics course enrollment patterns, college readiness of graduates, and post high school intentions.

Figure 1 provides a visual representation of the relationships between the new graduation requirements, recently adopted more rigorous standards, and college readiness and the gap this study has examined.

Summary of Literature Review

Recommendations from educational groups, government reports, as well condition of the economy have influenced states increasing high school graduation requirements which have impacted the high school course enrollment patterns at the both national and state levels. At the

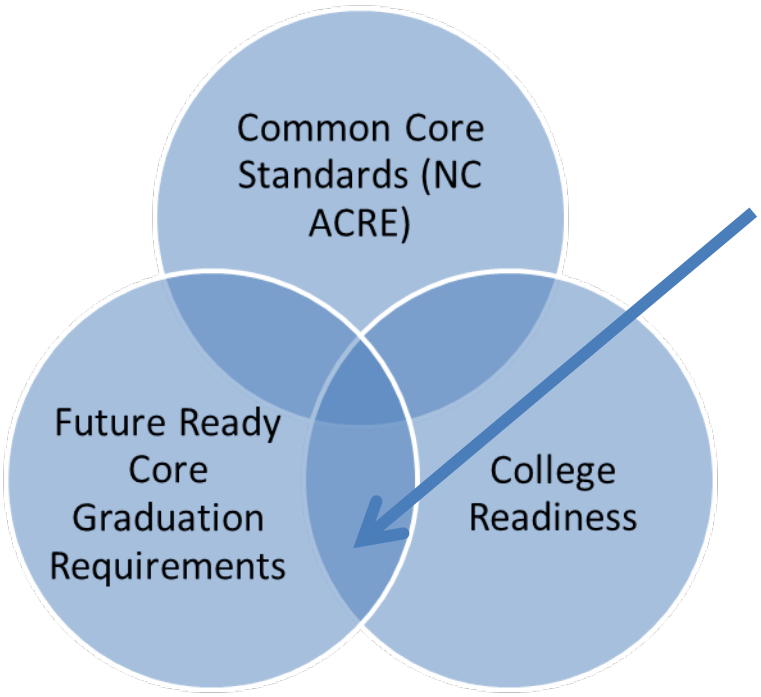


Figure 1. Summary of North Carolina reform initiatives & concerns overlap.

national level, the increased graduation requirements generally impacted course enrollment in remedial or mid-level courses taken at the beginning of the college preparatory sequence, which was a result of ambiguity or various tracks within the increase graduation requirements (Clune & White, 1992; Publication of Education Trust, 1999; Sebring, 1987). North Carolina mirrored the national trend of increasing high school graduation requirements from 16 to 21 courses with the various pathways within the graduation requirements.

The proportion of students who need college remediation is often cited as a major economic imperative. Community college remediation rates average has been reported between 50 and 54% over the past twenty years by various researchers (Adelman, 1999; McCabe & Day, 1999). In North Carolina Community Colleges 69% of students enrolled in remedial courses during the 2011-2012 academic year (Liston, 2012).

In response to the high college remediation rates and evolving job market, educational groups have recommended more rigorous, universal high school graduation requirements. North Carolina recently adopted the Future Ready Core High School Graduation requirements that call for the completion of four math courses through Algebra II plus one advanced math option with a limited substitution option.

CHAPTER 3: METHODOLOGY

The purpose of chapter three was to provide an overview of the research context, review of questions, instrumentation, data population, data collection procedures, and data analysis methods for this study. The chapter begins with a rationale for the study from chapter one.

Rationale for Study

In September of 2008, the North Carolina State Board of Education revised the high school graduation requirements to the Future Ready Core for freshmen starting in 2009 (Graduation requirements, 16 NCAC 6D .0503 2009). High school graduates were now required to complete four college preparatory math courses. The courses were to include Algebra I, Geometry, and Algebra II plus one advanced math course with a limited substitution option of replacing the last two math courses with identified career technical education courses. This new policy aligned with national recommendations by American Diploma Project and National Governor's Association (2004) for all graduates to complete a college ready high school course of study. The new policy also was supported by research that shows positive correlations in tests scores and post-high school readiness when students enrolled in more uniform rigorous courses requirements (Adelman, 1999; ACT, 2012; Chaney et al., 1997; Lee et al., 1997; Teitelbaum, 2003; Warburton et al., 2001).

The Future Ready Core graduation requirements differed from previous Year 2000 graduation requirements in the amount and level of rigor in mathematics. In the Year 2000 graduation requirements, students selected from four preparatory pathways such as career, career tech, university or occupational according to their post high school plans (NCDPI, 2001). The primary differences in the first three mentioned preparatory pathways are at the level of mathematics and if an elective career specialization or foreign language was required. More

specifically, career preparatory pathway required completion of Algebra I; career tech preparatory pathway required completion of Tech Math II; and University preparatory pathway required completion of Algebra II and two foreign languages. The fourth pathway was designed for students with special needs. Occupational preparatory pathway required special education math courses. In contrast, in the Future Ready Core graduation requirements, all students followed the same pathway. The Future Ready Core pathway required the completion of Algebra I, Geometry, and Algebra II plus one advanced math course with a limited substitution option of replacing the last two math courses with identified career technical education courses.

Politicians and policy makers often relate education reform to improving economic conditions. Throughout the education reform era, educators, researchers, and policy makers proposed increasing high school graduation requirements, content standards, teacher competency, length of school day, and length of school year. Policy makers most commonly chose increasing high school graduation requirements since the 1980s as an education reform strategy. Increasing high school graduation requirements as compared to other recommendations was often selected due to cost efficiency and the assumption of a causal effect to increased student achievement (Bracey, 2009; Chaney et al., 1997; Clune & White, 1992; Schiller & Muller, 2003; Sebring, 1987). The Future Ready Core graduation requirement adoption in 2008 was another occurrence of an ongoing education reform.

Impact of Increasing High School Graduation Requirements

Over the past thirty years, the majority of the states in the United States implemented policy changes in secondary education that increased high school graduation requirements. The policy changes included increasing the total number of courses needed for high school graduation as well as increasing the number of higher-level core classes in math, sciences, and

foreign languages. Increasing high school graduation requirements meant that students were expected to successfully complete higher-level courses. States and school systems added mid-level courses to help students learn pre-requisite content or to remediate those students who were not expected to successfully learn the higher level of coursework. However, according to transcript studies, the additional graduation requirements generally increased course enrollment in remedial or mid-level courses taken at the beginning of the college preparatory sequence as a result of multiple preparatory pathways within the increased graduation requirements (Clune & White, 1992; Publication of Education Trust, 1999; Sebring, 1987). Remedial or mid-level courses lacked the rigor to prepare a student for college or the workforce. In mathematics, mid-level or remedial courses were increased to replace Geometry and Algebra II. Examples of mid-level courses included business or technical math (Lee & Burkham, 2003).

As the high school graduation requirement increased over the course of the past thirty years, the United States faced a financial hardship due to the expense of college and workforce remediation as well as lost revenue to international competition from an underprepared workforce. Community colleges, universities, manufacturing industries, and researchers reported the need for increased remedial programs for high school graduates upon entering their programs (ACT, 2004; Conley, 2007; Greene & Winters, 2005; Strong American Schools, 2008; Wise, 2008). Achieve, Inc., and the National Governors Association (2005) projected 16 billion dollars were lost annually in college and workforce remediation. Strong American Schools Projects (2008) projected 2 billion dollars were lost annually in productivity from an underprepared work force. Furthermore, North Carolina Community Colleges experienced increases in community college remediation rates and costs of underprepared high school graduates. During the 2011-2012 academic year, 69% of freshmen enrolled in at least one

remedial course in North Carolina Community Colleges (Liston, 2012). During the 2012-2013 academic year, college remediation courses accounted for 105 million dollars of community colleges budgets of which 58 million dollars were directly state funded (B. Schneider, personal communication, January 8, 2014).

Statement of Problem

Considering the past national trends of high school course enrollment patterns when high school graduation requirements were increased, and the current state of increased college remediation course enrollment, this study will describe the impact of the Future Ready Core graduation requirements on high school mathematics course enrollment, college mathematic readiness, and post high school intentions. More specifically, the study will address the extent of the policy's implementation as prescribed at the state level and North Carolina public school system level. Additionally, the study will describe the impact of the policy implementation on improving college math readiness, which will address the validity of the premise of increasing graduation requirements positively impacting community college math readiness. The study will also describe the potential impact of the policy on graduates' post high school intentions.

Purpose of Study

The purpose of this study was to examine high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions of Future Ready Core Graduates at the state and North Carolina public school system level. The study compared Future Ready Core graduates to graduates that completed the Year 2000 requirements prior to the implementation of Future Ready Core. The study examined high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions during the planning and implementation of the Future Ready Core requirements in North Carolina public

school systems. Quantitative methodology was used to analyze high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions and determine whether the Future Core Ready requirements resulted in an increase of completion of at least three or more college preparatory mathematic courses, average mathematic Scholastic Aptitude Test (SAT) scores, or shifts in graduates' post high school intentions.

Research Questions

In order to determine the impact of the Future Ready Core mathematics graduation requirements on high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions at the state level and North Carolina public school system level the following six questions were considered for this study.

1. To what extent did the proportion of students completing three or more college preparatory math courses change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
2. To what extent did the proportion of students completing three or more college preparatory math courses change among small, mid-size, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
3. To what extent did average Math SAT scores change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

4. To what extent did average Math SAT scores change among small, mid-sized, and large sized North Carolina public school systems among the high school graduates since the announcement and implementation of Future Ready Core requirements?
5. To what extent did the proportion of graduates' post high school graduation intent plans change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?
6. To what extent did the proportion of graduates' post high school graduation intent plans change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

Research Design

The following sections address the quantitative study research design including data source, instrumentation, data collection and analysis methods.

Data Source

Data recorded for all high school graduates from 2008 through 2013 from 115 North Carolina public school systems. The researcher's university Institutional Review Board (IRB) approval was gained through following the appropriate request at the institution. The researcher then accessed the data on the North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports from 2008 through 2013. North Carolina public school system size was determined by using United States Census county populations tables according to the National Center for Education Statistics standards for small, mid-sized, and large.

Instrumentation

The data source consisted of high school graduates between the graduation classes of 2008 and 2013 from 115 North Carolina public school systems. The researcher's university Institutional Review Board (IRB) approval was gained through following the appropriate request at the institution. The researcher then accessed the data on the North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports for 2008 through 2013. North Carolina public school system size was determined by using United States Census county populations tables according to the National Center for Education Statistics standards for small, mid-sized, and large.

Data Collection

High school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions data from North Carolina Department of Public webpages was exported to Microsoft Excel. The Statistical Profile Interactive app collects data for on each high school graduation class by course and post high intention at school and school district levels annually based on graduate transcript data. North Carolina Department of Public Schools also compiles the average SAT report annually based on the College Board reports of all students taking the SAT reporting for each school and school district.

North Carolina public school system sizes were identified as "small", "mid-sized", or "large" according to counties reported Census population and recorded 0, 1, and 3 respectively for data analysis purposes. The other indicators for the state and each North Carolina public school system was recorded in accordance to information listed North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports for 2008 through 2013:

- The number of graduates who completed three college preparatory math courses as prescribed by the Future Ready requirements.
- The number of graduates who indicated on the post high school intent plans as four-year college or university, two year community college and other choices.
- The total number of high school graduates.
- The average mathematic SAT score.
- The high school graduation year was recorded as 2008 through 2013.
- The name of the North Carolina public school district.

All student data was recorded in a Microsoft Excel file and transferred to Statistical Package for Social Sciences (SPSS) for data analysis.

Data Analysis

Due to the data source including the entire population of North Carolina public high school graduates, descriptive statistical methods were used to summarize the data instead of inferential statistics using SPSS. Categorical variables were summarized in frequency tables. Quantitative variables were summarized by means, range, and standard deviation for each graduation year. The categorical variables considered were year of graduation and the size of the school system. The quantitative variables considered were total number of high school graduates who completed at least three college preparatory mathematic courses completed; total number of high school graduates; average math SAT scale score of each school system; and number of graduates self-reporting the intent to enroll in four-year college or two-year community college. Due to the data source, the 2013 graduating class college preparatory mathematic course completion totals represents four college preparatory mathematic courses, but will be treated as three college preparatory mathematic courses for a comparison point in this study.

From this data the proportions of North Carolina public high school graduates completing three or more college preparatory courses and attending four-year college or two-year community college at of each district were computed for graduating classes between 2008 and 2013 graduates. For the purpose of this study, the practical statistical significance level was determined by a change of more than ten percentage points or SAT scale score points during the implementation of the policy.

Assumptions

The following assumptions were considered when designing the study:

- The high school graduates in the study had a typical distribution of learning experiences and teacher competency throughout their high school careers.
- The participants in the study were permitted to self-select their respective high school mathematics curriculum pathway they completed for graduation.
- The participants who completed non Future Ready Core required math curriculum were provided instruction and grade level experiences as set forth by the North Carolina Standard Course of Study.

Limitations of the Study

The data sources for the study included the North Carolina Public School Statistical Profile interactive app and annual SAT reports from 2008 through 2013 has some limitations. The North Carolina Public School Statistical Profile provided only the numbers of each the course of study the completed per graduation year at the district level. Thus, the exact highest completed math course above Algebra II nor how many additional mid-level or remedial math courses completed during the high school experience was unknown. Additionally, the average SAT score database included underclassmen and could include multiple attempts of the same

students over the course of the data source's years. Considering the limitations of the data source was at the district level, the research questions were limited to policy implementation of the graduation requirements and possible impacts on the SAT average math scale score or proportion of students reporting four-year or two-year college plans.

Summary

This study utilized descriptive form of data analysis for comparing high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions of Future Ready Core Graduates at the state and North Carolina public school system level. The proportion of graduates completing three or more college preparatory mathematics, school district average SAT Math scores, proportion of post high school intention survey results, high school graduation year, and school district name were included in the data sets. The research questions analyzed through descriptive data tables. The practical statistical significance level was determined by a change of more than ten percentage points or SAT scale score points during the implementation of the policy. The analysis of each of the six research questions are discussed and presented in Chapter four.

CHAPTER 4: RESULTS

The study examined high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions during the planning and implementation of the Future Ready Core graduation requirements in North Carolina public school systems at the state and sized based school sub-group (small, mid-sized, and large) levels. More specifically, the study compared Future Ready Core graduates to graduates that completed the Year 2000 requirements prior to the implementation of Future Ready Core graduation requirements.

Population Description

All 115 North Carolina public school systems were used in the study's population. The school systems were sub-divided for analysis by overall population of their respective county size according National Center for Education Statistics (2006) size parameters of small (less than 100,000), mid-size (100,000 to 250,000), and large (greater than 250,000). There are 91 (79.1%) public school systems, which are classified as small; 18 (15.7%) classified as mid-size; and 6 (5.2%) as large (see Table 2). The number of high school graduates has been increasing in all three school system sub-divided groups and overall as a state during the 2008 through 2013 (see Table 3). The small sized school systems presented the highest average graduation total (37.7%) followed by the large sized school districts (33.3%) and mid-size school districts (29%) over the six-year timespan (see Table 4).

Research Question Data Disaggregation

The remainder of the chapter presents the findings for the six research questions in three paired question sections. The first findings section addresses the proportion of the graduates who completed at least three college preparatory math courses during the implementation of the Future Ready Core graduation requirements. The second finding section presents changes in

Table 2

North Carolina Public School System Sizes

Valid	Frequency	Percentage
Small	91	79.1
Mid-Size	18	15.7
Large	6	5.2
Total	115	100.0

Table 3

North Carolina Public School System Graduation Totals

School System Size	2008	2009	2010	2011	2012	2013
Small	32,361	32,865	33,177	33,833	34,659	34,209
Mid-Size	23,441	24,733	25,199	26,310	27,013	27,608
Large	26,817	28,145	29,178	30,300	31,301	31,865
State Total	82,619	85,743	87,554	90,443	92,973	93,682

Table 4

North Carolina Public School System Graduation Averages over 2008-2013

School System Size	Average over 2008-2013	Percentage
Small	33517.33	37.7
Mid-Size	25717.33	29.0
Large	29601.00	33.3
State Total	88835.67	100.0

average SAT math scores relevant to research questions three and four during the implementation of the Future Ready Core graduation requirements. Finally, the last section of findings addresses research questions five and six of graduates reporting post high school intention of attending four or two year college during the implementation of the Future Ready Core graduation requirements. Due to the data set including the entire population of North Carolina school districts, descriptive statistical methods were used to summarize the data instead of inferential statistics using Statistical Package for Social Sciences (SPSS). For the purpose of this study, the practical statistical significance level was set as a change of more than ten percentage points or SAT math scale score points during the implementation of the policy.

Research Questions 1 and 2

To what extent did the proportion of students completing three or more college preparatory math courses change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

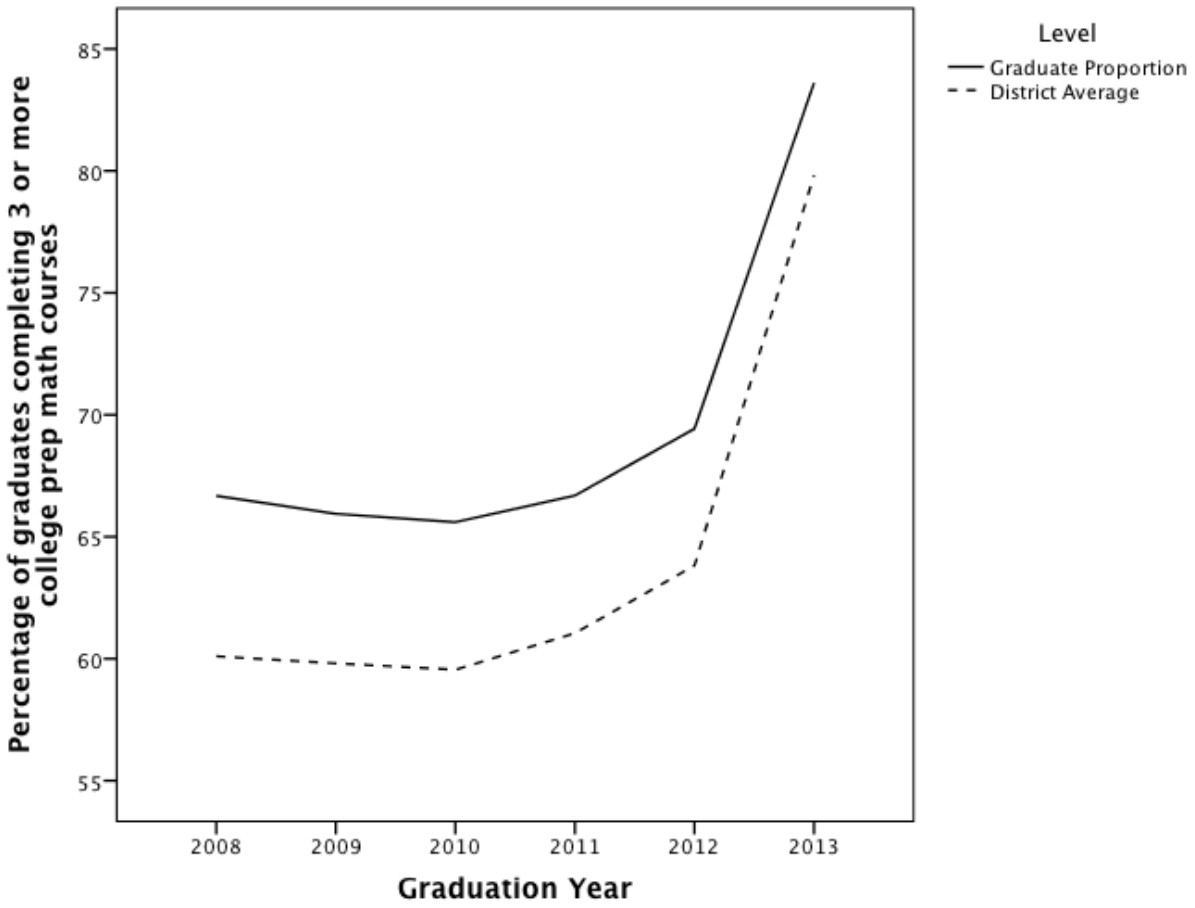
To what extent did the proportion of students completing three or more college preparatory math courses change among small, mid-size, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

This section presents the findings for questions one and two of the change in proportion of graduates completing three or more college preparatory math classes at state and school system sized based school sub-group levels (small, mid-sized, and large). The overall graduate proportion in North Carolina of completing three or more college preparatory courses stayed relatively flat between 65.60 and 69% until the first Future Ready Core graduating class in 2013. The proportion of graduates completing three or more college preparatory courses increased to

83.61% in 2013, which was an approximate 17-point increase and meets the pre-determined study's practical significance level. When examining all 115 North Carolina Public School systems' proportion of graduates completing three or more college preparatory classes, the school districts' average also stayed relatively static between 59.81% and 63.81% until the first Future Ready Core graduate class in 2013. The school districts' 2013 graduating class' average proportion of graduates completing three or more college preparatory math courses increased to 79.82%, which was a 19.72-percentage point increase from the 2008 graduating cohort and meets the pre-determined study's practical significance level (see Figure 2 or Table A1 in Appendix A).

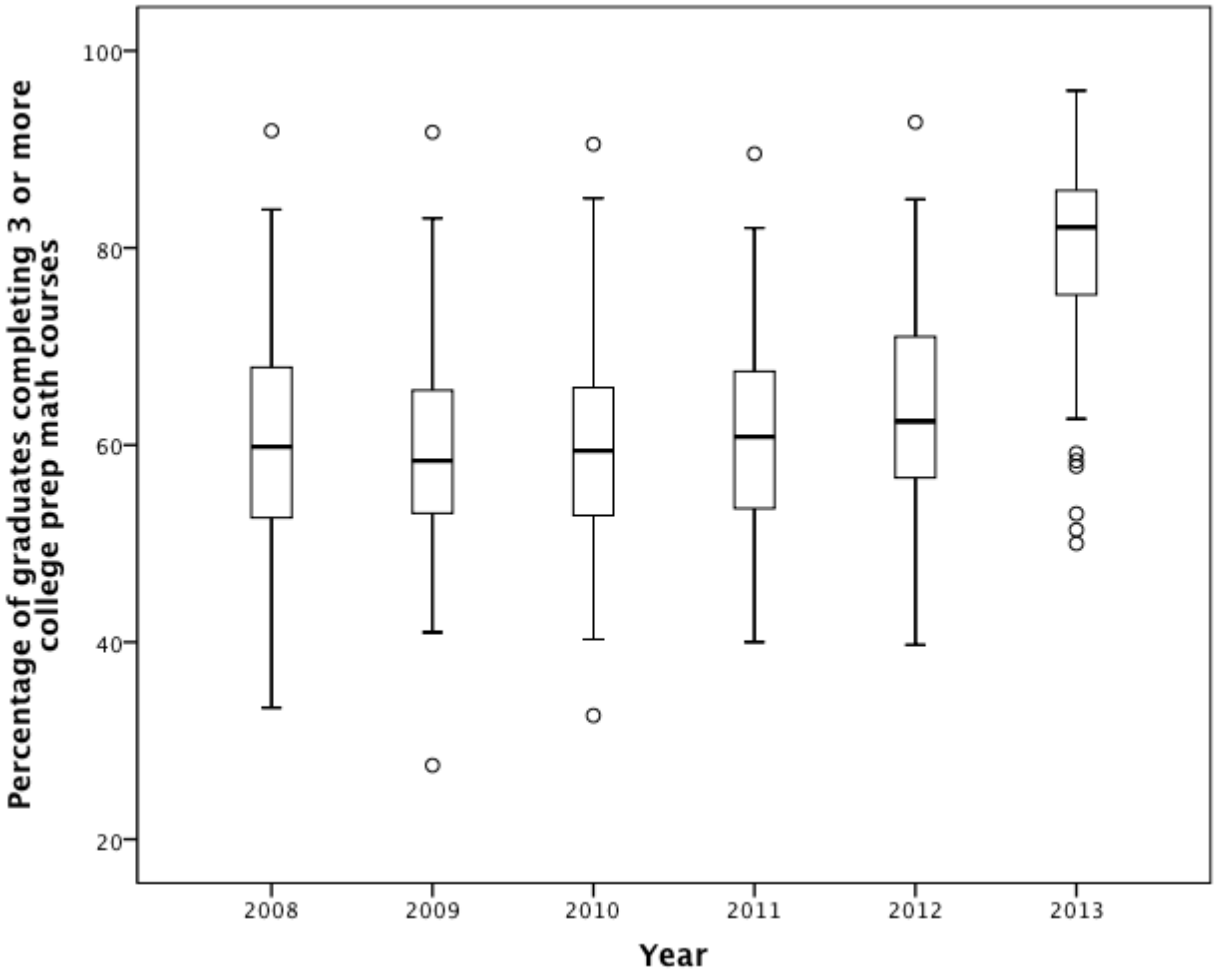
In 2008 and 2011, North Carolina district proportion of students completing three or more college preparatory math courses started to have shifts in variance among the North Carolina school districts. The minimum or lowest college preparatory proportion completion rate reported by any school district started increasing in 2009 after the announcement of the graduation requirement policy shift with the exception of one outlying district. After the 2011 graduation cohort or two years prior to the first Future Ready Core graduating class of 2013, the low outlier disappeared and the variance between the first and third quartile started to decrease incrementally (see Figure 3).

When examining North Carolina graduate proportion and North Carolina Public School systems average proportion of graduates completing three or more college preparatory as sub-groups based on size, a similar pattern of findings appear as reported at the state level with the increase in average proportions in 2013 at all three size sub-groups in both graduate proportion and district average of proportions. More specifically, the graduate proportion and district proportion average of students completing 3 or more college preparatory college math courses in



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 2. Proportion of graduates completing three or more college preparatory math courses.

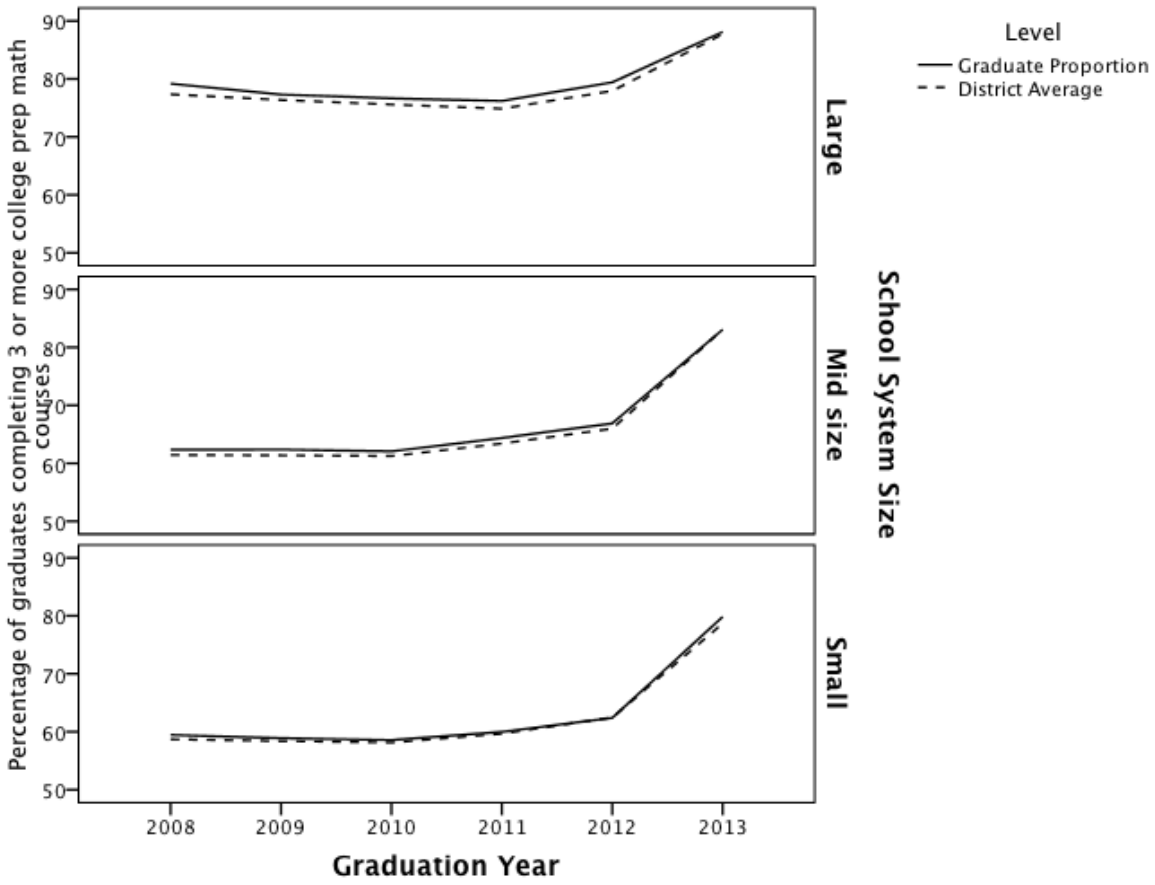


Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 3. North Carolina school districts' proportion of graduates completing three or more college preparatory math courses distribution.

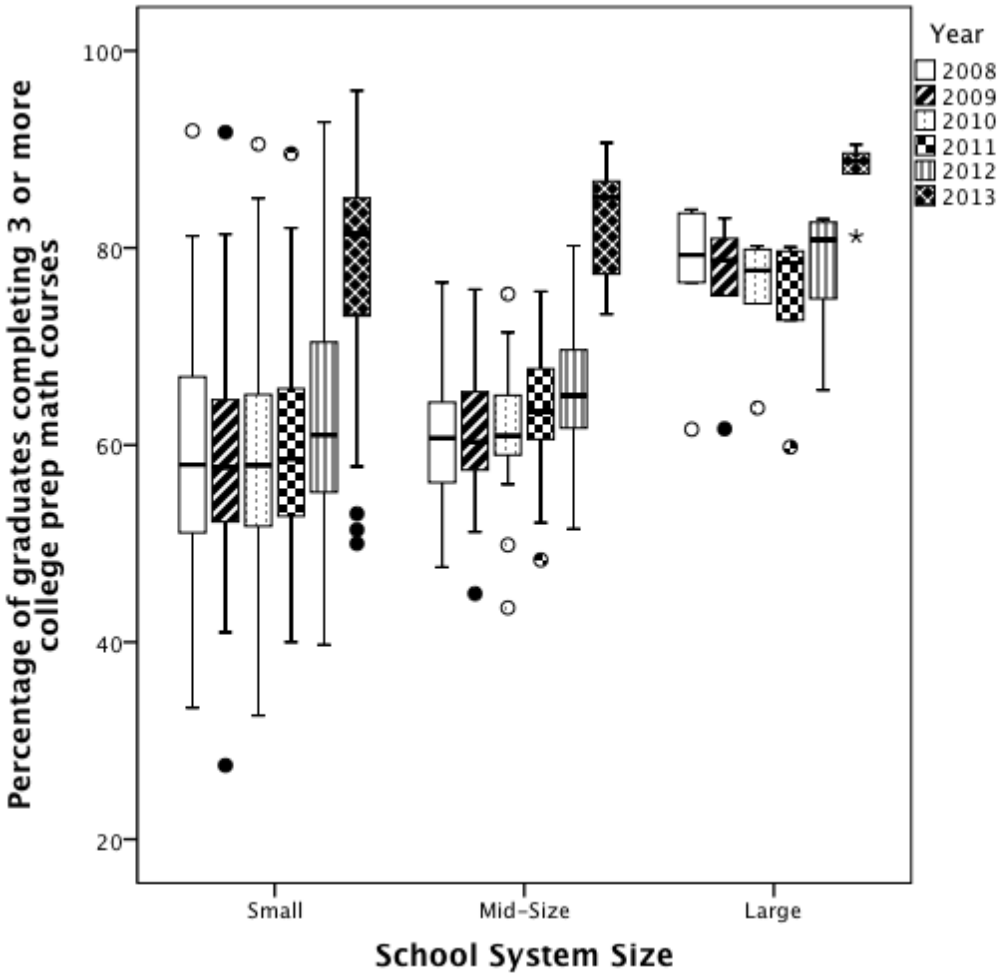
small sized school districts increased a respectively 20.78 and 19.96 percentage points to 79.84% and 78.66% as compared to the 2008 graduation cohort. The mid-size subgroup graduate proportion and district average proportion of students completing 3 or more college preparatory college math courses both increased to 83.09%, which was a respective 20.74 and 21.65 percentage points increase from the 2008 graduating cohort. The large size subgroup graduate proportion and district proportion average of students completing 3 or more college preparatory college math courses increased respectively to 88.11% and 87.73%, which was a 8.93 and 10.38 percentage points increase from the 2008 graduating cohort (see Figure 4 or Table A2 in Appendix A). The increase in small and mid-size school system subgroups met the pre-determined study's practical significance level at graduate proportion and district average proportion levels. Large school system subgroup's district average proportions increases also met the pre-determined study's practical significance level, but the large system subgroup proportion was near the pre-determined practical significant level.

Small and mid-sized school districts also had similar pattern as per the previous reported statewide data in the findings of variance, minimum, and lowest outliers of lowest college math preparatory proportion completion rates. Lowest outliers started increasing or disappearing leading up to the first Future Ready Core graduating class of 2013 (see Figure 5). The large size school districts minimum increases did not occur until the first Future Ready Core graduating class in 2013; however, the minimum outlier reporting largest district exceeded small and mid-size school districts by ten points throughout the implementation process.



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 4. Proportion of graduates completing three or more college preparatory math courses in each sized based subgroup.



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 5. North Carolina school districts' proportion of graduates completing three or more college preparatory math courses distribution based on size based subgroups.

Research Questions 3 and 4

To what extent did average Math SAT scores change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

To what extent did average Math SAT scores change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

This section presents the findings for questions three and four regarding the change in average Math SAT scores at state and school system sized based school sub-group levels (small, mid-sized, and large). The section also addresses the findings on percent of students who participated in the SAT math testing during the Future Ready Core graduation requirements implementation process for a potential controlling or contributing factor in the conclusion.

When examining graduate level and all 115 North Carolina Public School systems' average participation proportion in the SAT math testing during the implementation of Future Ready Core graduation requirements, the graduates and state districts' average increased 3.56 and 4.7-percentage points respectively between 2010 and 2012. However, the graduate proportion and state districts' average had a respective decrease of 6.09 and 6.48-percentage points during the first Future Ready Core graduate class in 2013 as compared to the graduate class in 2008. When examining graduate proportion and all 115 North Carolina Public School systems' average SAT participation as sub-groups based on size, a similar pattern of findings appear as reported at the state level with the increase in average in 2012 followed by a decrease in 2013 at all three size sub-groups (see Table 5).

Table 5

North Carolina Public School System SAT Percent Participation

School District Size		2008	2009	2010	2011	2012	2013
Small	N	91	91	91	91	91	91
	Graduate	51.36	47.95	50.43	54.72	55.47	49.11
	District Minimum	28.10	21.20	26.30	33.50	36.70	18.10
	District Maximum	93.10	83.00	87.10	85.90	89.70	82.90
	District Average	51.59	48.96	51.38	55.93	56.63	50.01
	District Std. Deviation	10.48	9.87	10.45	11.11	11.04	11.71
Mid-Size	N	18	18	18	18	18	18
	Graduate	54.07	50.31	53.12	57.15	57.95	52.12
	District Minimum	38.70	32.10	38.10	37.90	40.90	35.70
	District Maximum	67.80	63.60	63.80	68.70	70.80	66.80
	District Average	53.14	49.29	52.28	55.99	56.85	50.91
	District Std. Deviation	7.75	7.84	7.46	8.35	7.70	7.63

Table 5 (continued)

School District Size		2008	2009	2010	2011	2012	2013
Large	N	6	6	6	6	6	6
	Graduate	67.07	60.92	66.73	69.81	69.10	63.01
	District Minimum	53.20	51.30	56.60	55.90	56.20	53.70
	District Maximum	73.60	67.10	74.10	75.90	74.40	69.00
	District Average	65.48	59.78	66.02	68.48	67.93	61.87
	District Std. Deviation	6.86	5.34	6.65	7.05	7.01	6.14
State	N	115	115	115	115	115	115
	Graduate	57.29	52.97	56.73	60.55	60.85	54.76
	District Minimum	28.10	21.20	26.30	33.50	36.70	18.10
	District Maximum	93.10	83.00	87.10	85.90	89.70	82.90
	District Average	52.56	49.58	52.28	56.59	57.25	50.77
	District Std. Deviation	10.36	9.65	10.34	10.86	10.66	11.20

When examining graduate and all 115 North Carolina Public School systems' average SAT math scale scores, the graduate level and school district averages have had a decline during the implementation of the Future Ready Core graduation requirements. The graduate level and state school districts average SAT math scores decreased to 500.40 and 482.85 respectively, which was an 8.78 and 12.49-point decrease from 2008 (see Figure 6 and Table A3 in Appendix A). When examining graduate level and all 115 North Carolina Public School systems' average SAT math scores as sub-groups based on size, a similar pattern of findings appear as reported at the state level with the decrease in both graduate level and school district average in 2013 at all three size sub-groups. More specifically, average SAT math scale scores decreased to 489.54 at the graduate level and 479.08 at the school district average in small sized school districts, which were a respective 11.41 and 12.42-point decreases from 2008. The mid-size school districts graduate level and district average scale SAT math scores decreased to 502.54 and 497.72 respectively, which was an 11.48 and 14.61-point decreases from 2008. The large size school graduate level and districts average SAT math scale scores decreased to 500.4 and 497, which was an 8.78 and 7.17-point decreases from 2008 (see Figure 7 and Table A3 in Appendix A). The graduate level average decreases at the small and mid-size levels as well as the overall state, small and mid-size school systems level average decreases met the pre-determined study's practical significance level over the course of the Future Ready Core graduation requirement implementation.

The variance in the district average SAT math scale scores at the state level during the Future Ready Core graduation requirements implementation had limited downward shift in the quartiles and increase in the difference between the lowest and highest outliers (see Figure 8 and Table A3 in Appendix A). As per the size-based subgroups, small and mid-size school districts

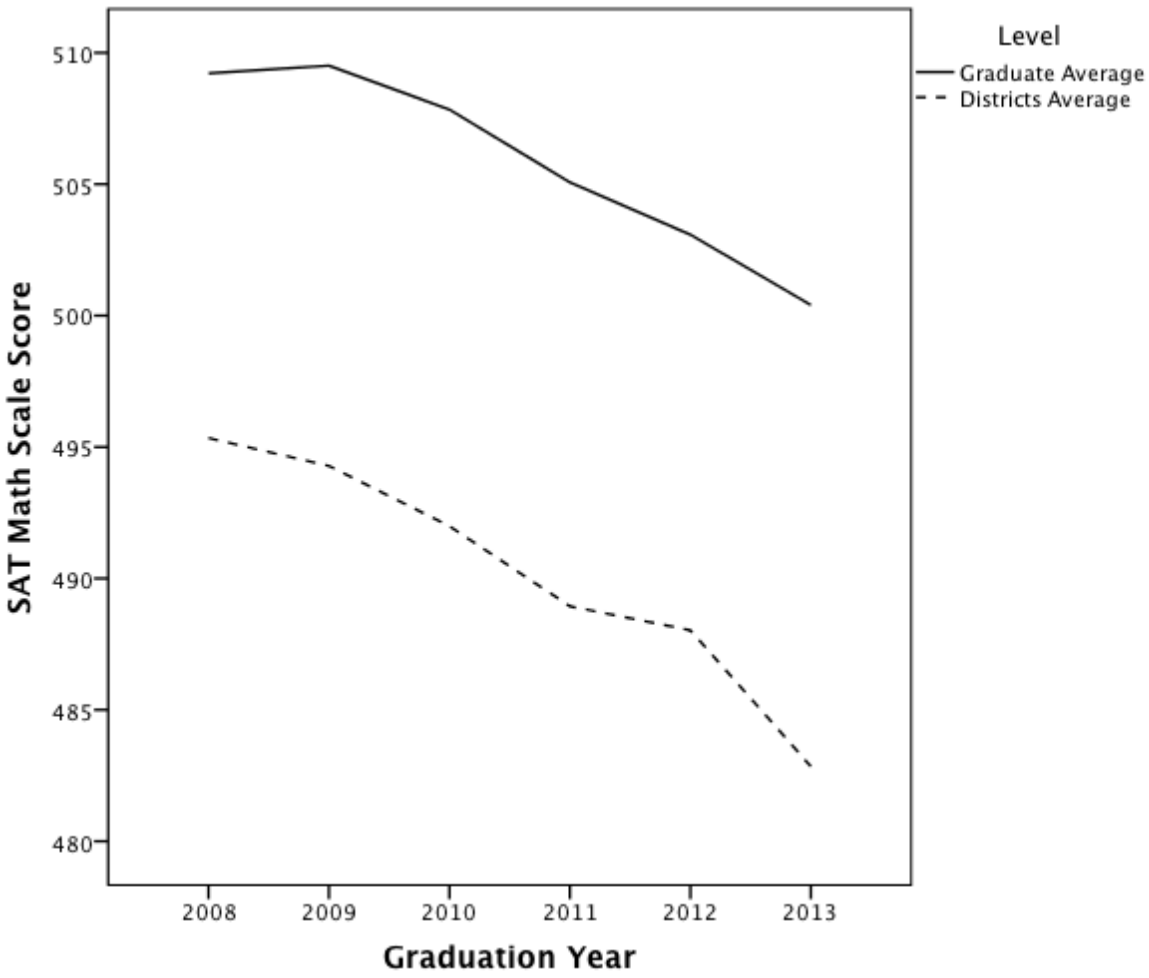


Figure 6. Average SAT math scale score during the implementation of the Future Ready Core graduate requirements.

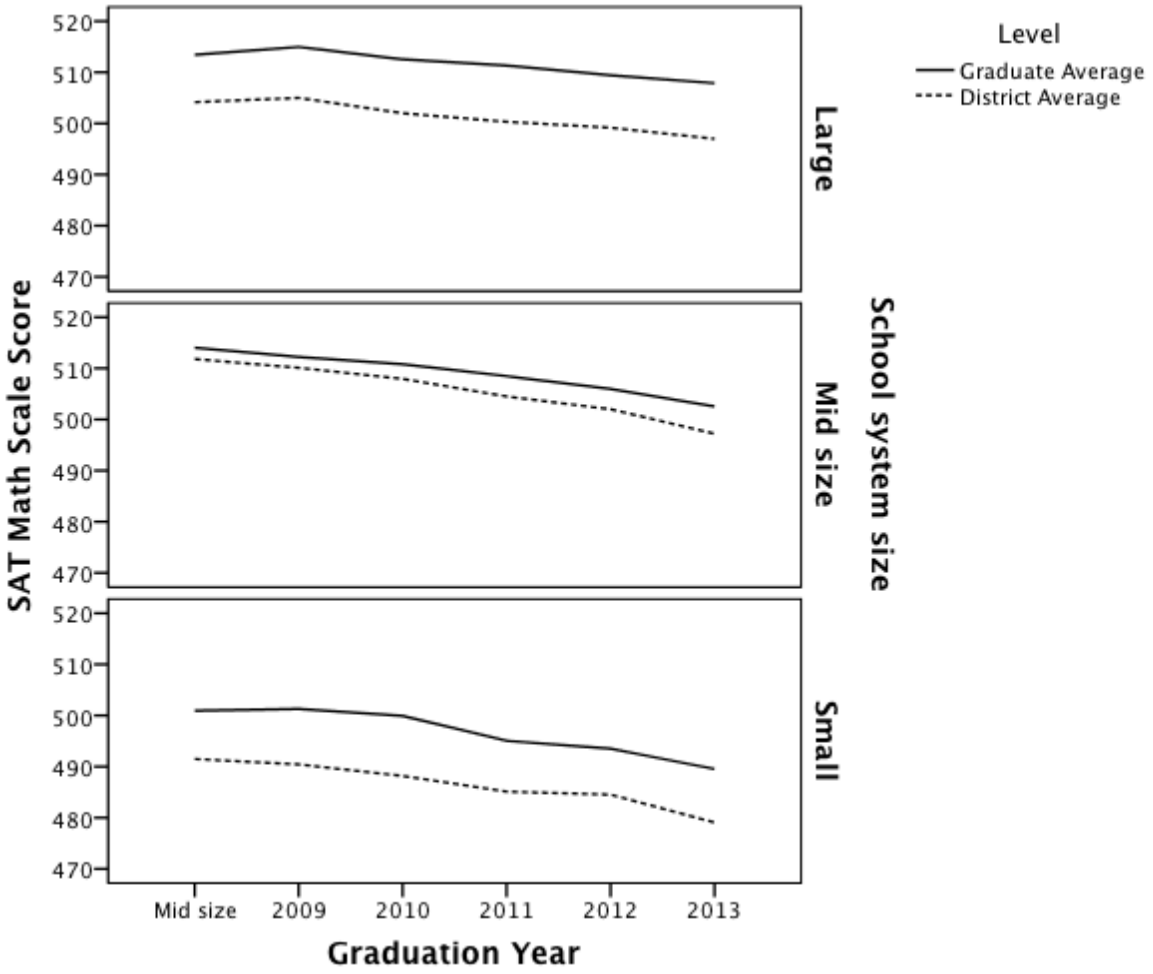


Figure 7. District average SAT math scale score during the implementation of the Future Ready Core graduate requirements at the school system size levels.

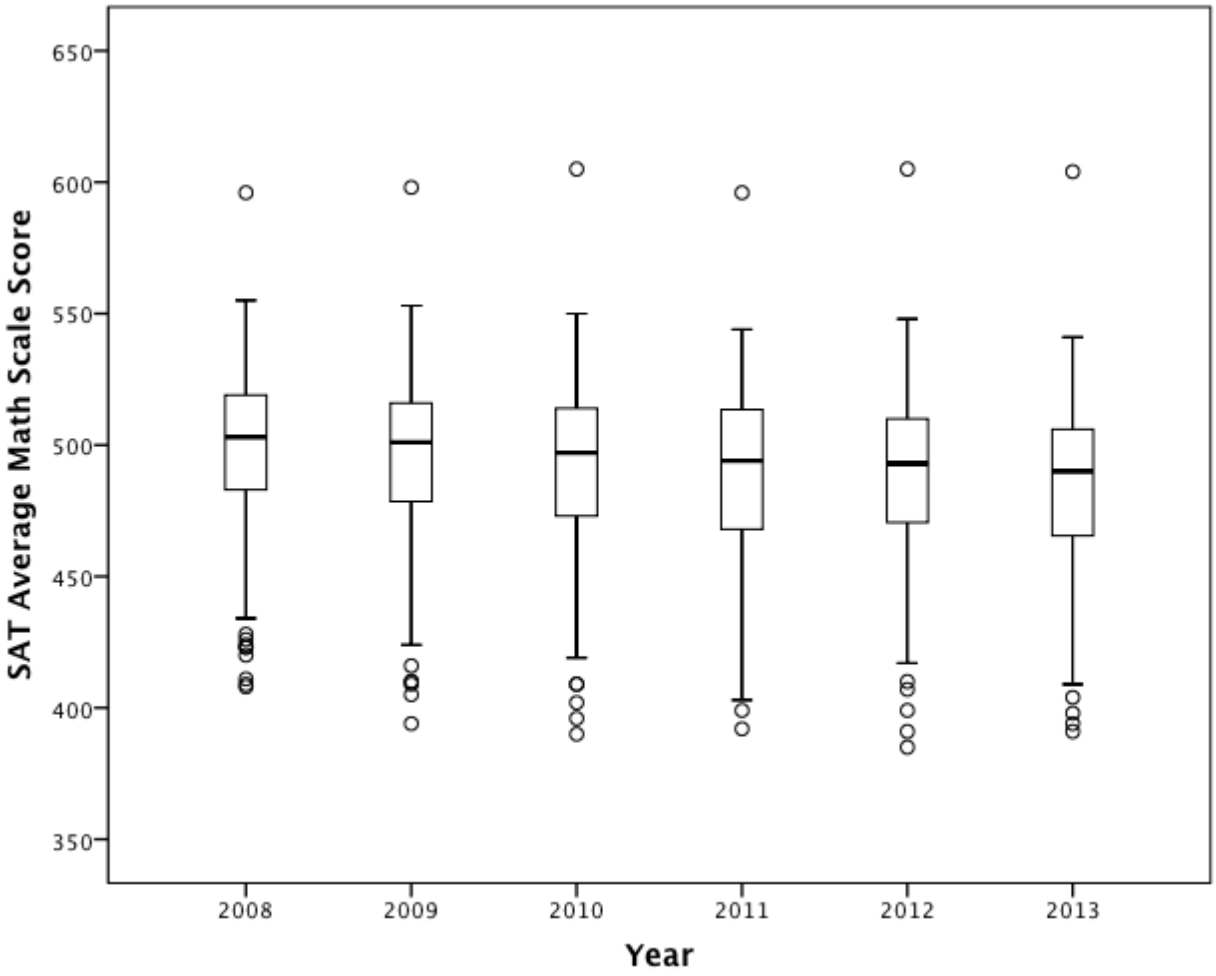


Figure 8. North Carolina school districts' average SAT math scale scores distribution.

also have had a limited downward shift in quartiles, but only the small size school systems observed an increase in the difference between the lowest and highest outliers (see Figure 9 and Table A2 in Appendix A).

Research Questions 5 and 6

To what extent did the proportion of graduates' post high school graduation intent plans change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

To what extent did the proportion of graduates' post high school graduation intent plans change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

This section presents the findings for questions five and six of the change in proportion of graduates post high school graduation intention plans at state and school system sized based school sub-groups levels (small, mid sized, and large). Four-year, two-year, and total college intention proportion rate changes are shared as separate findings for comparison in chapter five. When examining graduate level and school systems average proportion of graduates post high school graduation intent plans of attending a four-year college, the graduate proportion and state's school district average stayed relatively static with less than a respective 2.34 and 2.3-percentage points movement during the Future Ready Core graduate requirement implementation process (see Figure 10 and Table A4 in Appendix A). When examining four-year college intent plan proportions in sub-groups based on size, a similar pattern of findings appears as reported at the state level for the small and mid-size school systems sub-groups remaining relatively static during the same time period. The large school graduate proportion and districts' average

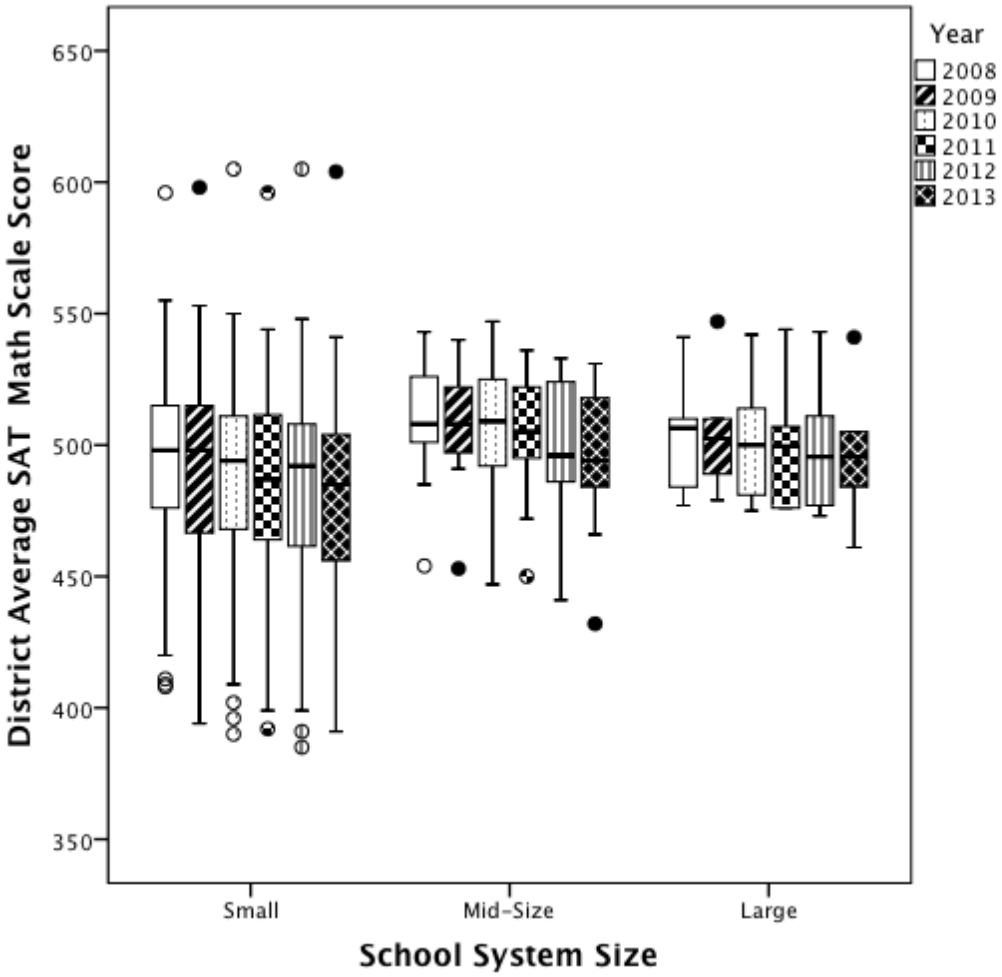
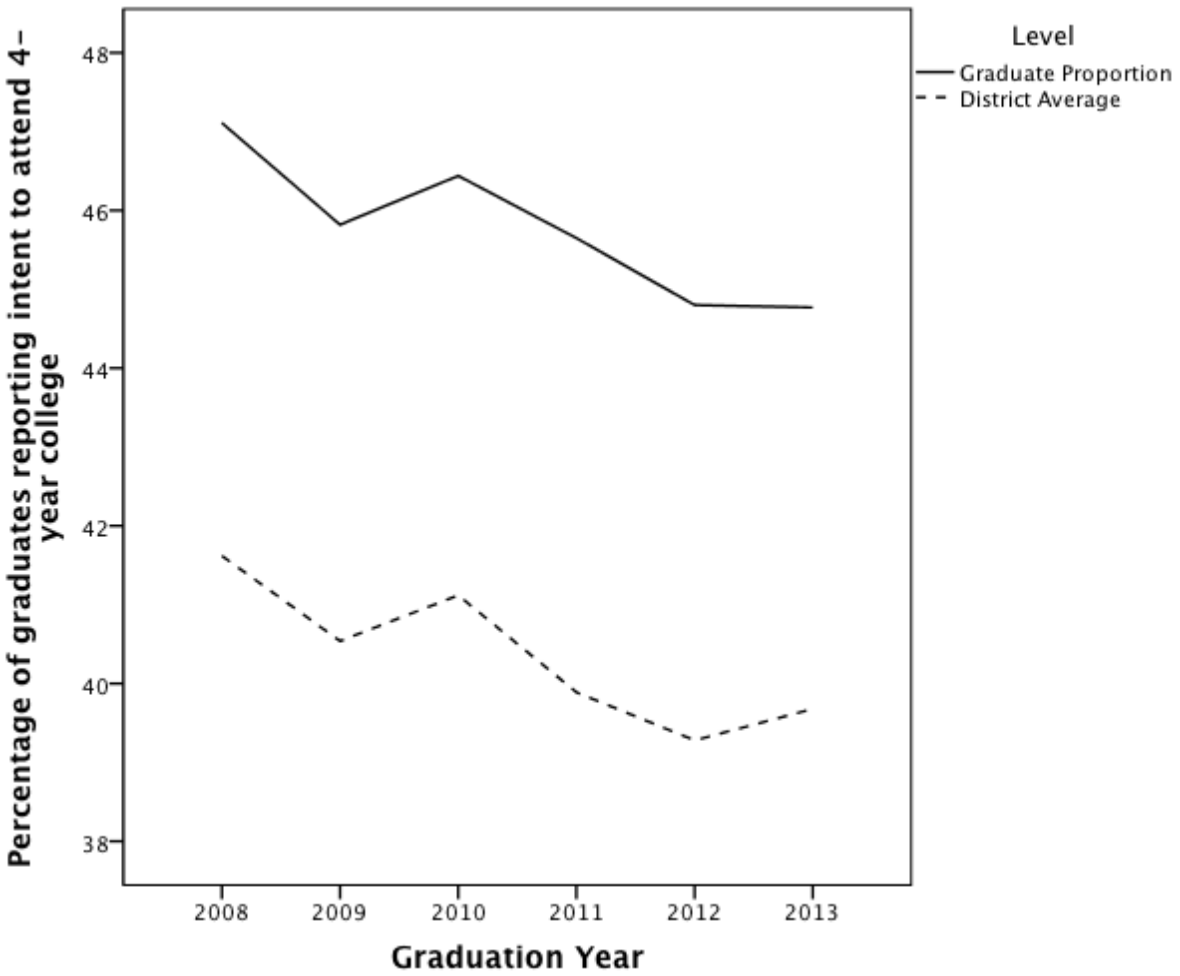


Figure 9. North Carolina school districts' average SAT math scale scores distribution based on school system size subgroups.



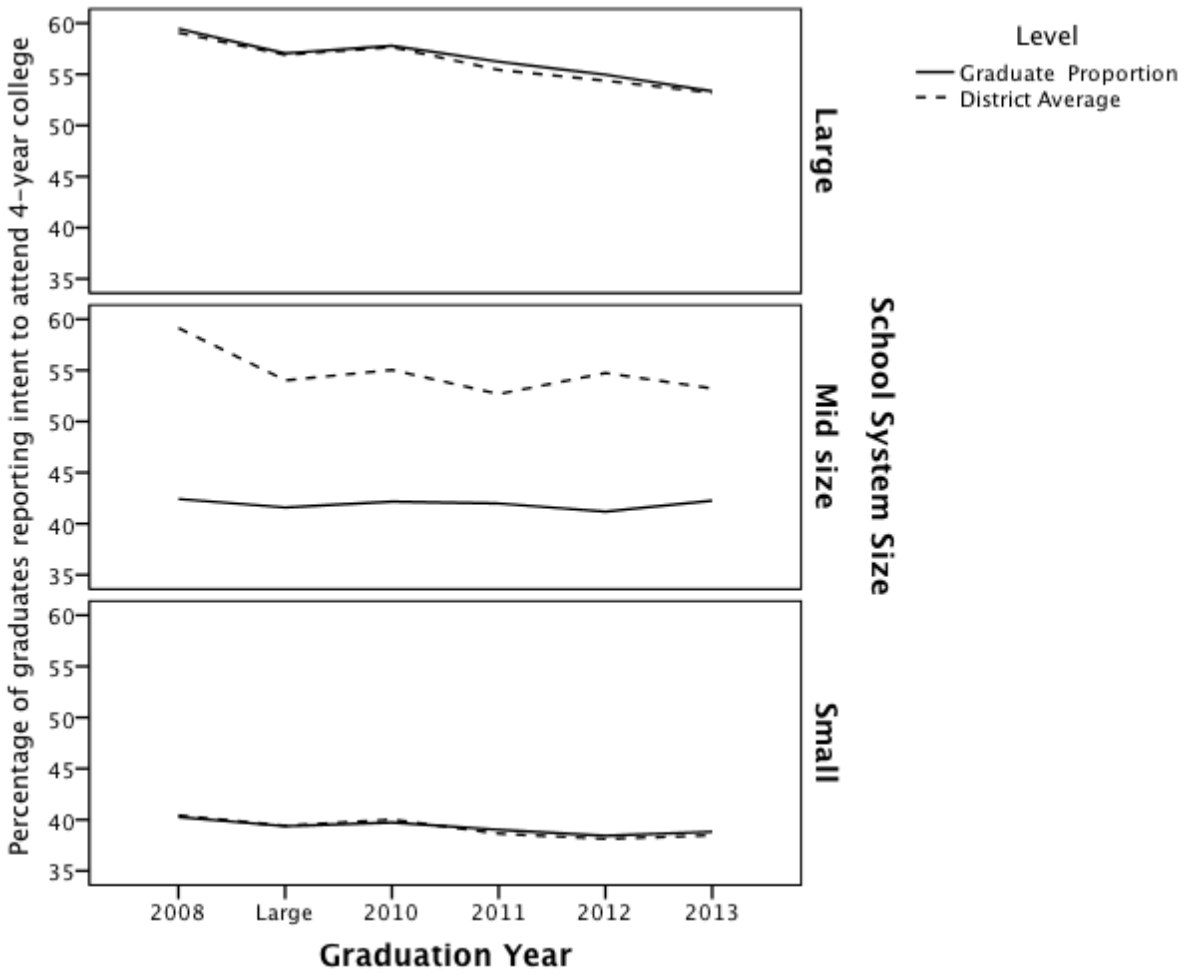
Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 10. Proportion of graduates reporting intent to enroll in four-year colleges.

proportion of four-year college intent proportion decreased to 53.34% and 53.20% in 2013 respectively, which was a 6.12 and 5.87 percentage points decrease from 2008. However it should be noted even with the decrease in large size school graduate level and school systems' average of four-year college intention proportions, the large school systems' intention rate exceeds small and mid-size school systems by at least 10 percentage points (see Figure 11 or Table A4 in Appendix A). The state's four-year intent graduate and district averages proportion rates as well as all size based subgroups average decreases did not meet the pre-determined study's practical significance level over the course of the Future Ready Core graduation requirement implementation.

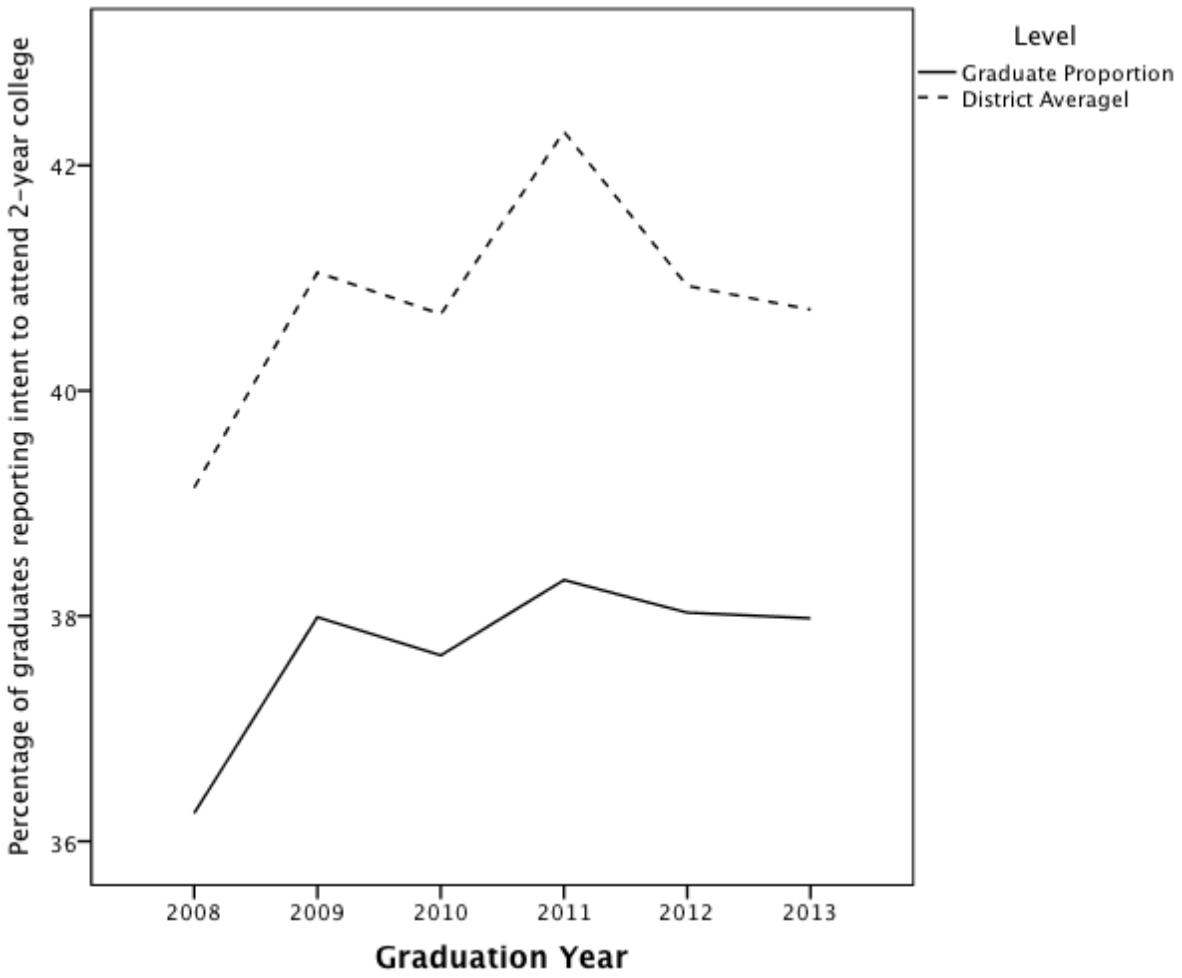
When examining graduate level and school systems average proportion averages of graduates proportion of graduates post high school graduation intent plans of attending a two-year college, the graduate proportion and school district average proportion stayed relatively static with less than a respective 1.73 and 1.58 percentage points movement between 2008 and 2013 (see Figure 12 and Table A4 in Appendix A). When examining two-year college intent plan in sub-groups based on size, a similar pattern of findings appears as reported at the state level with all three sub-groups remaining relatively static during the same time period with less than 4.5 percentage point movement. Even though all three subgroup means remained static, the large school systems' two-year college intention rate trails small and mid-size school systems by approximately 10 percentage points (see Figure 13 and Table A5 in Appendix A). The decreases in graduate and district average two-year college intent proportion rates did not meet the pre-determined study's practical significance level over the course of the Future Ready Core graduation requirement implementation at the state or any size-based subgroup level.

When examining graduate level and school systems averages proportion of graduates



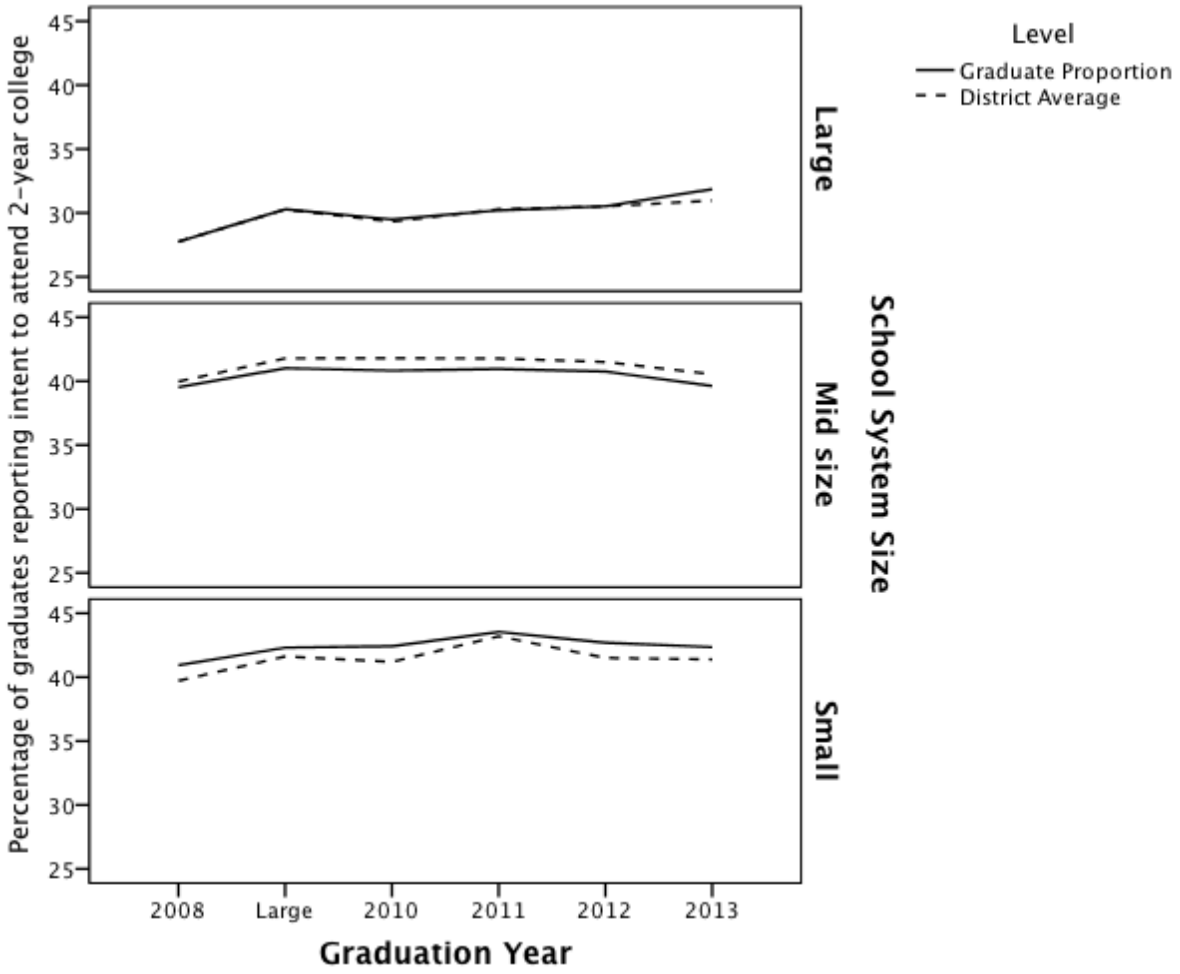
Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 11. Average school district proportion of graduates reporting intent to enroll in four-year colleges based on size subgroups.



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 12. Proportion of graduates reporting intent to enroll in two-year colleges.



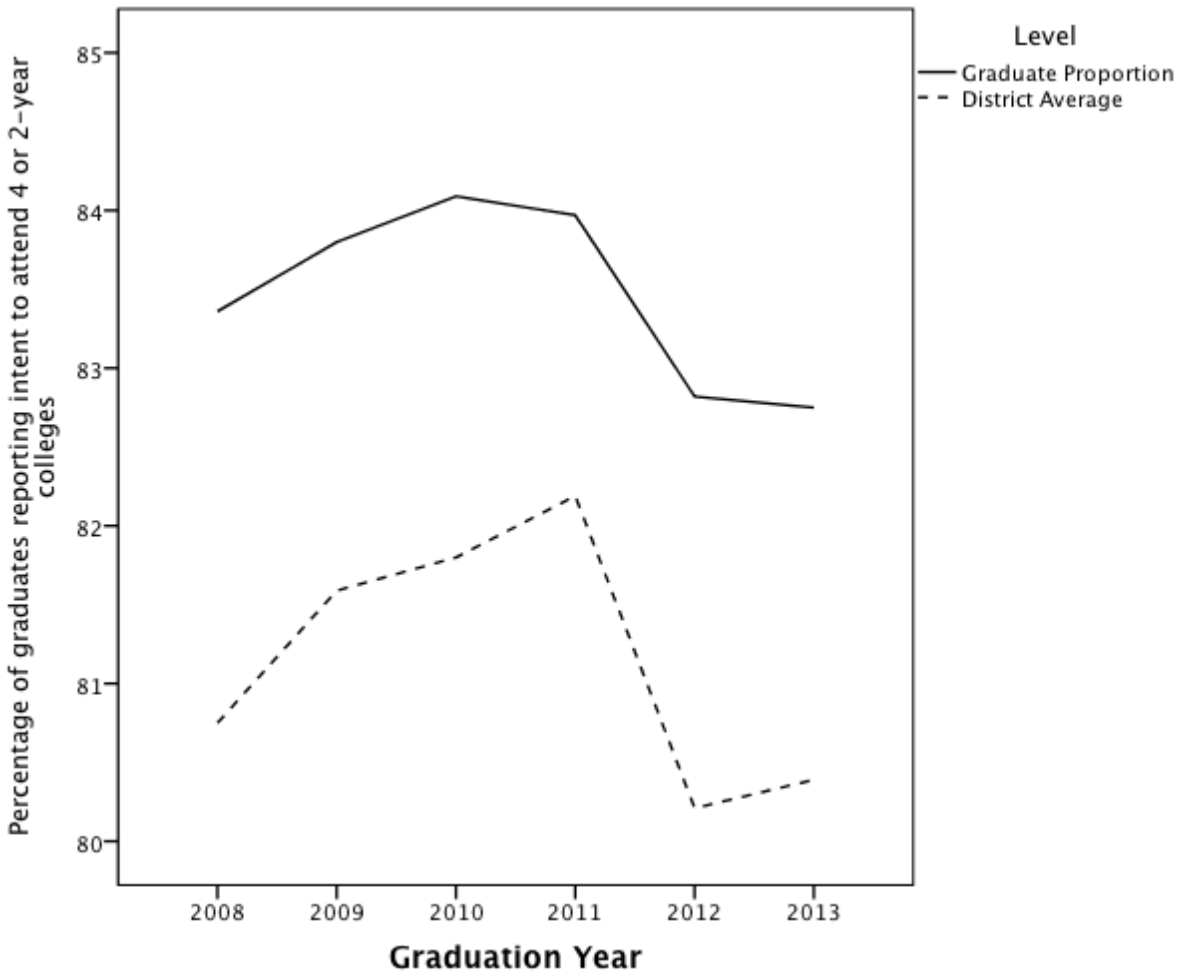
Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 13. Average school district proportion of graduates reporting intent to enroll in two-year colleges based on size subgroups.

post high school graduation intent plans of attending two or four-year college, the graduate proportion and state's average proportion stayed relatively static with less than a two percentage points movement during the implementation of Future Ready Core graduation requirements (see Figure 14 and Table A6 in Appendix A). When examining two or four-year college intent plans in sub-groups based on size, a similar pattern of findings appears as reported at the state level with all three sub-groups remaining relatively static during the same time period with less than two-percentage points of movement. Even though all three subgroup averages remained static, the large school systems' two or four-year college intention rate exceeds small and mid-size school systems by a respective 2.36 and 4.30 percentage points (see Figure 15 and Table A6 in Appendix A). The state's two or four-year intent graduate level and district average proportion rates as well as all three size-based subgroups average decreases did not meet the pre-determined study's practical significance level over the course of the Future Ready Core graduation requirement implementation.

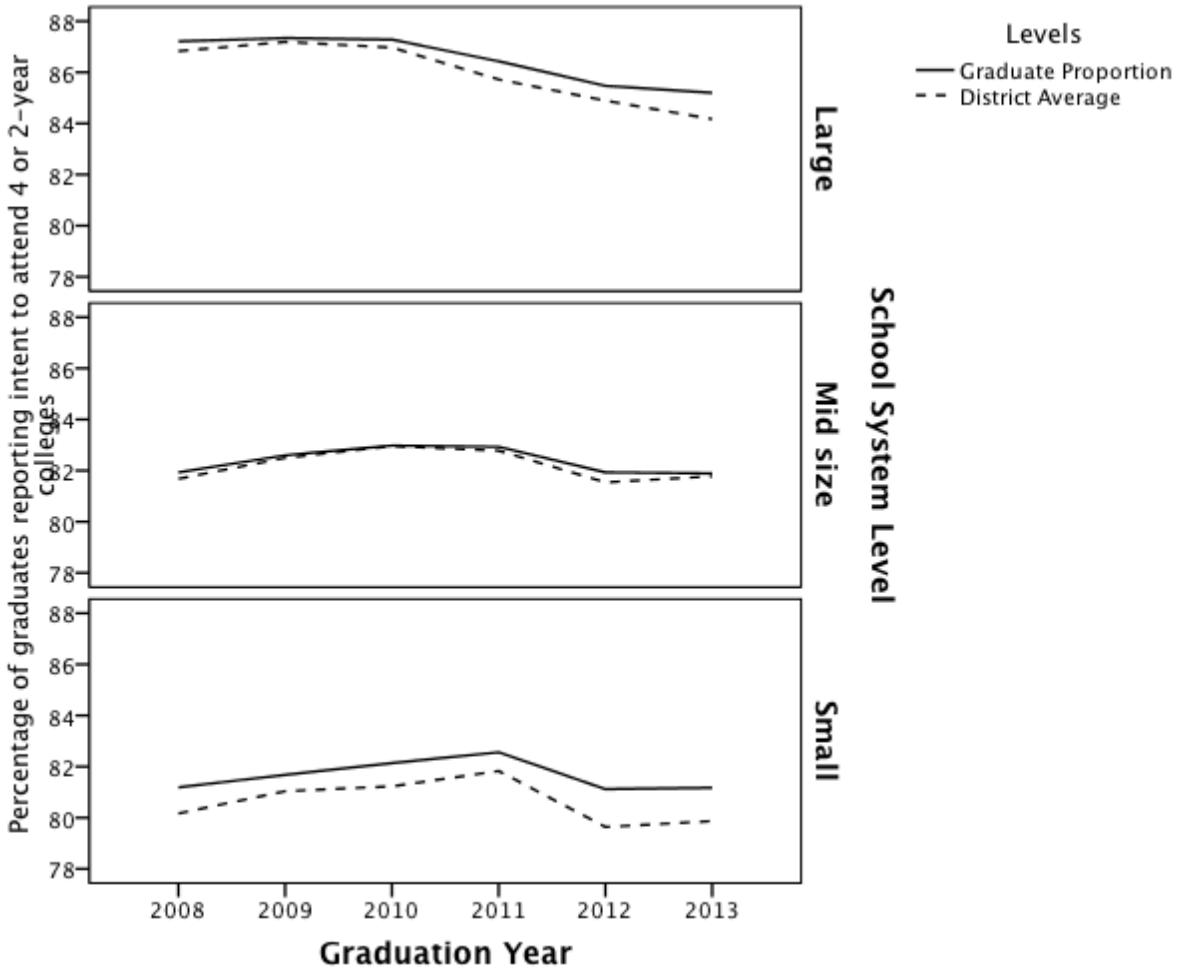
Summary of Findings

The high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions' findings during the planning and implementation of the Future Ready Core requirements in North Carolina public school systems at the state and size based school system subgroup level (small, mid sized and large) were mixed according the pre-determined study's practical significance level of change of ten point or more. The proportion of high school graduates completing at least three college preparatory math courses increased significantly at the graduate and school district levels at the state, small and mid-size subgroups and large-size subgroup district average proportion when the policy was fully implemented in 2013. The school system average SAT math scale score levels had a significant decrease



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 14. Proportion of graduates reporting intent to enroll in four or two-year colleges.



Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Figure 15. Average school district proportion of graduates reporting intent to enroll in four or two-year colleges based on size subgroups.

at both the graduate and school district levels over the course of the implementation at state as well as small and mid-size school system sub-group levels. The proportion of graduates reporting post high school intention plans of attending a two or four year college were fairly static and did not have a significant change at the graduate or school district level at any sub-group levels. Regardless of the significance levels on the six research questions, large sized school systems had overall higher averages than small and mid-size school systems. Chapter five discusses the interpretations, conclusions and implications of the aforementioned findings.

CHAPTER 5: SUMMARY AND DISCUSSION

The purpose of this study was to examine high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions during the planning and implementation of the Future Ready Core graduation requirements in North Carolina public school systems at the a state and sized based school sub-groups levels (small, mid sized, and large). The prior chapter presented the results for each of the research questions in three paired sections with a predetermined practical significance level of a change of ten percentage or scale points. The study's population included all 115 North Carolina public school systems for the graduating classes from 2008 through 2013. The school systems were sub-divided for analysis by overall population of their respective county size according National Center for Education Statistics (2006) size parameters of small (less than 100,000), mid-size (100,000 to 250,000), and large (greater than 250,000). This chapter summarizes the prior chapter's findings for each pair of research questions, connects the study's findings to prior presented findings in chapter two, discusses implications for school leaders and concludes with study limitations as well as potential future research suggestions.

Research Questions Summaries and Literature Connections

The six research questions are paired in three sections according to their respective dependent variable. Each section examined and assessed for practical significance at the state and size subgroup level for the graduate proportion and district average proportion of each research question's defined dependent variable. A summary of the study's findings is presented in Table 6. The following sections summarize and connect chapter four's findings to previously reported research findings in chapter two's literature review.

Table 6

Summary of Practical Significance Results for Research Question

	Small		Mid-Size		Large		State	
Questions	Graduate	District Average	Graduate	District Avg.	Graduate	District Avg.	Graduate	District Avg.
1 & 2	Yes, Increase	Yes, Increase	Yes, Increase	Yes, Increase	No	Yes, Increase	Yes, Increase	Yes, Increase
3 & 4	Yes, Decrease	Yes, Decrease	Yes, Decrease	Yes, Decrease	No	No	No	Yes, Decrease
5 & 6	No	No	No	No	No	No	No	No

Research Questions 1 and 2

To what extent did the proportion of students completing three or more college preparatory math courses change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

To what extent did the proportion of students completing three or more college preparatory math courses change among small, mid-size, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

The increase in the proportion of high school graduates completing at least three college preparatory math courses was at a practical significant level at the graduate and school district levels at the state, small and mid-size subgroups and large-size subgroup district average proportion when the policy was fully implemented in 2013. The increases in the graduate proportion levels between 2008 and 2013 at the small, mid-size and state level ranged from 16.93 and 20.74-percentage points. The change in district proportion averages at levels between the 2008 and 2013 ranged between 10.38 and 21.65-percentage points (see Table 7). However, the large increases in college preparatory math course proportions at all level and subgroups occurred in 2013 or when the Future Ready Core high school graduation requirements were fully implemented.

Based on the study's findings, the full implementation of the North Carolina Future Ready Core graduation requirements differed with the previous reported studies of increased high school graduation requirements on college preparatory math course in chapter two in timeliness of increases and the highest math course completed. Clune (1989), Clune and White (1992), and Sebring (1987) reported previously that increased math graduation requirements

Table 7

Summary of Changes in Graduate and District Average Proportion Rates of Graduates Completing Three or More College Preparatory Math Courses During the Implementation of the Future Ready Core Graduation Requirements

Level	Graduate Percentage 2008	Graduate Percentage 2013	Graduate Percentage Change	District Percentage Average 2008	District Percentage Average 2013	District Percentage Average Change
Small	59.46	79.84	20.38	58.7	78.66	19.96
Mid-Size	62.35	83.09	20.74	61.44	83.09	21.65
Large	79.18	88.11	8.93	77.35	87.73	10.38
State	66.68	83.61	16.93	60.10	79.82	19.72

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

impacted only remedial or mid-level courses below Algebra II at significant level and did not significantly increase proportion rates of graduates completing three or ore college preparatory math courses. Chapter two findings also outlined how the increase of graduation math requirements impacted the proportions of graduates completing three or more college preparatory math courses. Findings in the review of literature indicated that the proportions were gradual increases of 31% in 1983 (National Commission on Excellence in Education, 1983) to 67% in 2000 (U.S. Department of Education, 2010).

Comparatively in this study, the proportion rate of graduates completing three or more college preparatory math courses increased to 83.61% or 16.93-percentage points at the state level, which was at a practical significant level and the revised North Caroline Future Ready Core graduation requirements had a more immediate impact after the first year of full implementation of the new high school graduation requirements. Additionally, the data set in this study for the 2013 graduation year actually represents the proportion of graduates who completed four or more college preparatory math courses. Thus, the 83.61% reported state rate exceeds the national findings of Planty and Provasnik (2007) who reported student enrollment in advanced math past Algebra II had increased to 50% in 2004 from 26% in 1983.

Overall, the study's results of graduate and district average proportion rates of graduates completing three or more college preparatory math courses during the implementation of the Future Ready Core Graduation Requirements showed significant increases in all sub-groups and levels with the exception of large size school systems graduate proportion rate. The aforementioned increases most likely can be credited to the new graduation math requirements increase of the minimum of two-college preparatory math courses with specific titles in the policy and more specifically written limited substitution options. This is quite different than

previously reported ambiguous course types and various tracks in prior graduation requirements that resulted in disconnect in the design of graduation requirements and actual implementation of policy (Publication of Education Trust, 1999). Additionally, the minimum two-college preparatory math courses requirement also eliminated what Kelly (2007) cited as self-selected less rigorous graduation pathways during their eighth grade year as per student-parent informed elected year or school personnel placing students in the lower pathways by scheduling lower math sequences and core subject classes during a student's freshman and sophomore years due to not having required prerequisite school or district determined test scores or course grades for the more rigorous courses.

Research Questions 3 and 4

To what extent did average Math SAT scores change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

To what extent did average Math SAT scores change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

The average SAT math scores decreased at a practical significant level when the policy was fully implemented in 2013 at the following levels and subgroups: graduate levels at the small and mid-size subgroups as well district average at small, mid-size subgroups and state level. The decreases in the graduate average SAT math scale scores between 2008 and 2013 at the small and mid-size level were a respective 11.41 and 11.48 scale points. The decreases in district averages SAT math scale scores at small, mid-size and state levels between the 2008 and 2013 ranged between 12.42 and 14.61 scale points (see Table 8). Overall, the decreases in

Table 8

Summary of Changes in Graduate and District Average SAT Math Scale Scores during the Implementation of the Future Ready Core Graduation Requirements

Level	Graduate Average 2008	Graduate Average 2013	Graduate Average Change	District Average 2008	District Average 2013	District Average Change
Small	500.95	489.54	-11.41	491.5	479.08	-12.42
Mid-Size	514.02	502.54	-11.48	511.83	497.22	-14.61
Large	513.43	507.88	-5.55	504.17	497	-7.17
State	509.22	500.4	-8.82	495.34	482.85	-12.49

average SAT math scale scores at all levels and subgroups occurred fairly steadily over the course of the implementation of the Future Ready Core high school graduation requirements between 2008 and 2013.

Since all graduates are not required to take the SAT exam, the SAT average proportion rates were examined during the implementation of North Carolina Future Ready Core graduation requirements as control or contributing factor of the previously reported findings. The graduates and state districts' average increased 3.56 and 4.7 percentage points respectively between 2010 and 2012. However, the graduate proportion and state districts' average had a respective decrease of 6.09 and 6.48 percentage points during the first Future Ready Core graduate class in 2013 as compared to the graduate class in 2008. When examining graduate proportion and all 115 North Carolina Public School systems average SAT participation as sub-groups based on size, a similar pattern of findings appear as reported at the state level with the increase in average in 2012 followed by a decrease in 2013 at all three size sub-groups. A reasonable contributing factor for the decrease between 2012 and 2013 could be the state-wide implementation of the ACT during the junior year for all 2013 graduates as part of the North Carolina Accountability Curriculum Reform Effort. Regardless, the limited shifting in the proportion of graduates taking the SAT had a little to no effect on the SAT average math scale score at the graduate or district average state or sub-group levels. It is important to note that the SAT has not undergone a re-norming process during the times of this study. Therefore the assessment itself is controlled.

Based on the study's findings, the full implementation of the North Carolina Future Ready Core graduation requirements differed with the previous reported studies of increased, more rigorous high school graduation requirements on college readiness and student achievement in chapter two. Chaney et al. (1997), Lee and Burkam (2003), and Lee et al. (1997)

reported positive correlations for students completing the more rigorous course work. More specifically, increasing high school coursework's intensity demonstrated positive correlations at significant levels for students qualifying at college ready level (ACT, 2012; Aldeman, 2006; Bartha, 2004; Attwell & Domina, 2008; Norman et al., 2011).

Comparatively in this study, the findings as per average SAT math scores did not mirror the aforementioned Chapter two research findings of increased rigorous coursework significantly positively impacting college readiness achievement scores. The North Carolina Future Ready Core graduation requirements require four college preparatory math courses with a limited substitution option, which was more uniform than the prior Year 2000 graduation requirements. However, SAT average math scale scores decreased at significant levels at the graduate at the small and mid-size subgroups and district average SAT math scale scores at small, mid-size and state level when the policy was fully implemented in 2013. Potential implications for school leaders and limitations of the data set will be discussed in the later in the chapter.

Research Questions 5 and 6

To what extent did proportion of graduates' post high school graduation intent plans change among North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

To what extent did proportion of graduates' post high school graduation intent plans change among small, mid-sized, and large sized North Carolina public school systems high school graduates since the announcement and implementation of Future Ready Core requirements?

The change in proportion of high school graduates indicating intent to enroll in a two or four-year college was not at a practical significant level at the graduate or school district average proportion level when the policy was fully implemented in 2013. The proportion of the

graduates reports intent to enroll in a four-year university declined at the graduate and district average proportion levels at all subgroups between 0.16 and 6.12- percentage points (see Table 9). The proportion of the graduates who reported intent to enroll in a two-year university increased at the graduate and district average proportion levels at all subgroups between 0.57 and 3.21-percentage points (see Table 10). The proportion of the graduates reports intent to enroll in a two or four-year university stayed static at the graduate and district average proportion levels at small and mid-size subgroups as well state level changes being less than 1-percentage point of variance. However, large size sub-group graduate proportion and district average proportions declined respectively 2.01 and 4.46-percentage points (see Table 11).

Chapter two's findings presented the concept of disconnect between graduate course enrollment patterns due to various tracks among the graduation requirements and college aspirations (Achieve, 2004; Publication of Education Trust, 1999). For example, the Publication of Education Trust (1999) reported a 20-percentage point discrepancy between students who responded with a desire to attend college and students who reported taking the appropriate coursework. Additionally, Achieve reported 30% of students are taking coursework necessary for college or post-secondary readiness, but 70% will enroll in a college or other post-secondary opportunities.

Based on the aforementioned studies' findings, the more uniform rigorous Future Ready Core graduation requirements would decrease coursework admission requirement obstacles and thus increase the amount of graduates' intent to enroll two or four year college. However in this study, the increase in graduation requirements as well as increase proportion of graduates completing three or more college preparatory math courses did not significantly impact the proportion of graduates reporting intent to attend two or four-year colleges. More specifically,

Table 9

Summary of Changes in Graduate and District Average Proportion Rates of North Carolina Graduates Indicating Intent to Enroll in Four-Year Colleges

Level	Graduate Percentage 2008	Graduate Percentage 2013	Graduate Percentage Change	District Percentage Average 2008	District Percentage Average 2013	District Percentage Average Change
Small	40.26	38.82	-1.44	40.44	38.47	-1.97
Mid-Size	42.42	42.26	-0.16	41.71	41.25	-0.46
Large	59.46	53.34	-6.12	59.07	53.2	-5.87
State	47.11	44.77	-2.34	41.62	39.68	-1.94

Table 10

Summary of Changes in Graduate and District Average Proportion Rates of North Carolina Graduates Indicating Intent to Enroll in Two-Year Colleges

Level	Graduate Percentage 2008	Graduate Percentage 2013	Graduate Percentage Change	District Percentage Average 2008	District Percentage Average 2013	District Percentage Average Change
Small	40.93	42.69	1.76	39.72	41.39	1.67
Mid-Size	39.52	40.75	1.23	39.97	40.54	0.57
Large	27.75	30.52	2.77	27.76	30.97	3.21
State	36.25	38.03	1.78	39.14	40.72	1.58

Table 11

Summary of Changes in Graduate and District Average Proportion Rates of North Carolina Graduates Indicating Intent to Enroll in Two and Four-Year Colleges

Level	Graduate Percentage 2008	Graduate Percentage 2013	Graduate Percentage Change	District Percentage Average 2008	District Percentage Average 2013	District Percentage Average Change
Small	81.19	81.17	-0.02	80.17	79.87	-0.30
Mid-Size	81.93	81.89	-0.04	81.68	81.78	0.10
Large	87.21	85.2	-2.01	88.63	84.17	-4.46
State	83.36	82.75	-0.61	80.75	80.39	-0.36

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

only the large sized school systems graduate proportion and district average proportions had a difference of more than 5-percentage points during the course of the implementation of the Future Ready Core graduation requirement, which was a decrease.

Implications for School Leaders

Over the course of the implementation of the Future Ready Core graduation requirements, the proportion of graduates completing three or more college preparatory math courses, average SAT math scale scores, and proportion of graduates reporting intent to attend two or four-year college presented findings that differed from previously reported research in both positive and areas that need further improvement for school leaders. In this section, the implication of the findings for the aforementioned focus areas is discussed with a special emphasis on past and current trends in North Carolina education reform efforts, the degree of impact of the new graduation requirements on the different size school districts and potential next steps for school leaders.

Three or More College Preparatory Math Course Completion Rates

The proportion of graduates completing three or more college preparatory courses increased significantly at a practical level among graduate and districts average proportion levels at all subgroups with the except of large school district subgroup graduate's proportion rate. The findings reflect North Carolina Future Ready Core graduation requirements were implemented with fidelity by school leaders as compared to the previous studies of implementation of multi-track and less rigorous graduation requirements. While the increases were significant, the graduate proportion and district average proportions of graduates using the limited substitution option or occupational course of study in lieu of completing three or more college preparatory math courses ranges was 16.39 and 20.18-percentage points respectively. The aforementioned

percentages provide evidence of Achieve's (2004) reported disconnect that exists between high school math course selection and post high school required skills. Hence, school leaders should implement additional strategies and student supports to lower the use of the substitution option even further. Some strategies could include a consistent monitoring of the proportion of graduates completing three or more college preparatory math courses; investigating the possibility of factors such as what Kelly (2007) referred to as student self-selected opt out and prior academic performance school policies that influence course selection; as well as sharing best practices with school districts of similar size whose three or more college preparatory math courses rates are higher.

The district average proportion of graduates completing three or more college preparatory math courses as size-based subgroups over the course and at the conclusion of the Future Ready Core graduation requirements also provides key information to school leaders. The policy closed the approximate 17 to 20-percentage point gaps between district average proportion rates between small and mid-size systems as compared to large systems; however the large district average proportion rates still exceed small and mid-size school districts by 8.27 and 5.02-pecentage points respectively (see Table 6). Additionally over the course of the policy implementation, the variance in the district average proportions had a slight decrease starting in 2011 and a larger increase in the 2013, which was the first year the new graduation requirements were required.

Based on the findings, large school system graduates have always had an increased likelihood of completing three or more college preparatory math courses, but the size based sub-group gap has decreased. When considering small and mid-size school system composed 66% of the state's graduation population, school leaders need to examine the practices, policies, and

resources that may be influencing less graduates to complete three or more college preparatory math courses. Some practices to consider may be amount of course opportunities, quality of math candidate pool, tutoring and enrichment opportunities.

Average SAT Math Scale Movement

The study's findings of practical significant decreases at graduate and district average SAT math scale scores among small and mid-size sub-groups and district average at the state level did not align to previously reported research of increased coursework having a positive correlation in post-high school readiness tests (Adelman, 1999; Chaney et al., 1997; Lee et al., 1997; Teitelbaum, 2003; Warburton et al., 2001). The aforementioned significant levels of decrease and non-significant decreases at the various sub-groups in the SAT average match scale scores are concerning for school leaders especially considering the increases in proportion of graduate and district average of graduations completing three or more college preparatory math courses.

When school leaders examine the inverse trend of increased college preparatory math coursework completed with decreased average SAT math scale scores, various factors are considered. First and foremost, school leaders need to consider the quality of teaching and learning that is occurring in college preparatory math courses since the implementation of the Future Ready Core graduation requirements by asking the following questions: Have the expectations of college preparatory course been lowered? Have the schools or math departments created various tracks within the math curriculum with the same course names and numbers? Have teachers been offered professional development to teach a wider range of mathematic aptitude learners the higher math content standards?

School leaders should also consider which curriculum standards and other uniform math assessments were in place for the graduates to measure the teaching and learning process. For example, the 2013 graduate most likely only completed one math course under the new Common Core Math standards. Additionally, the 2013 graduates were not required to take any other state mathematic assessments after the first college math preparatory course with the exception of the college readiness exams such as the SAT and ACT. Thus, school leaders consider the quality of the new standards as they are implemented and find a common, rigorous method to assess student learning to ensure college preparatory coursework results in an increase in college readiness.

The district average proportion of SAT math scale score as size-based subgroups over the course and at the conclusion of the Future Ready Core graduation requirements also demonstrate gaps to school leaders. Prior to the start of the Future Ready Core graduation requirements, the gap between large and mid-size school districts as compared to small districts was approximately 13 percentage points. However at the conclusion of the graduation requirements implementation, the gap between increased to 20 percentage points between large and mid-sized as compared to small districts. Resources such as amount of course opportunities, quality of math candidate pool, tutoring and enrichment opportunities need to be closely examined by school leaders to develop strategies that will close the district sub-group gaps in college readiness assessments.

Two and Four-Year Post High School Intention Rates

The static proportion rates of graduates stating intent to enroll in two or four-year colleges in conjunction with significant increases in graduate completing three or more college preparatory course during the implementation of Future Ready Core graduation requirements

inform school leaders that other factors influence or constrain graduates' post high school intent. However, the difference in the school size subgroups proportion rates among two-year intent as compared to four-year intent or two and four-year intent proportions should shape investigation into resources and practice of school leaders. Small and mid-sized school districts' graduation and district average proportions of intent to enroll in two-year college exceed large school district by approximately 12-percentage points. Comparatively, large school districts exceed small and mid-size school district proportion in 4-year intent rates; however the gap has decreased marginally since the implementation of the graduation requirements. When considering the static movement and discrepancies between the size based subgroups, school leaders need to the consider college exposure experiences, parental expectations, economic conditions, and potential space at four year institutions. Then examine strategies in which gaps can be shortened to ensure that all graduates receive the same opportunities regardless of the size of their school district.

Summary of Implications for School Leaders

Overall the findings presented a compelling case that school leaders successfully led the implementation of the Future Ready Core graduation requirements as compared to other graduation requirements implementations. However, the decreasing use of the substitution option for less rigorous math coursework, increasing college readiness performance, and raising the expectations of graduates' post-high school intentions need to be addressed by school leaders.

Recommendations for Policy Makers

The Future Ready Core high graduation requirements have increased proportion of graduates completing three or more college preparatory math courses. If only looking at this

finding the policy was successful in change in college preparatory course enrollment. However, college readiness indicator as defined in this study by SAT math scale scores indicates that the taking college preparatory courses did not positively impact SAT math scale scores. This implies a need for specific mathematic curriculum mapping to college ready standards, professional development of math educators, and additional mathematic support for struggling students.

It is also important for policy makers to understand that the SAT assesses aptitude and predicts first year college success rate. Policy makers need to consider several college readiness indicators in conjunction with the SAT to reach the impact of the Future Ready Core graduation requirements on college readiness.

Limitations to Research Study

The study provided initial data and findings on the impact of the Future Ready Core graduation requirements on college preparatory math course enrollment, college readiness as measured by the SAT math scale scores and graduates' post high intentions. The data set included all 115 North Carolina school districts' data, which were sub-divided into size-based subgroups. The data did not include student individual data for each of the three previously mentioned variables. Hence, the data can only be generalized to North Carolina's sized based subgroup and state level as point of comparison of descriptive data for trend movements.

Additionally, the SAT average scale scores data set presents a few concerns. The SAT average data set includes underclassmen and potential repeat scores. The accessible data set also does not include the time of year of the administration of the test; hence, graduates could have been in the process of taking the college preparatory math coursework. The ACT math data could have been a more efficient and aligned assessment as compared to the SAT; however,

ACT math data for each district was unavailable at the district level for the 2008 through 2012 graduation cohorts.

Recommendations for Further Research

In order to completely evaluate the implementation of the Future Ready Core graduation requirements, future research studies are required to address additional components of implementation and impact of the new high school graduation requirements. Additional analysis of total high school math coursework enrollment patterns at the district, size based sub-groups, and state level would provide comparison to previous implementation of new graduation requirements and next steps for school leaders. The total math coursework analysis would require student transcript studies or school level course number enrollment analysis. The analysis could include a specific focus on prerequisite math foundation courses prior to enrollment in college preparatory math courses, which could be compared to previous reported findings of increasing graduation requirements resulting in increased remedial or mid-level courses (Clune & White, 1992; Publication of Education Trust, 1999; Sebring, 1987). Additionally, the new information could also provide details in regards to potential math course tracking trends within the implementation of the new graduation requirements, which will provide school leaders additional information to consider if college readiness data continues to decline.

The ongoing impact of the Future Ready Core graduation requirements as well as the other ongoing North Carolina educational reform initiatives can also be measured by repeating a similar study of math course college preparatory enrollment patterns and college mathematic readiness every three to five years. However, the average ACT math composite score should be

substituted for the average SAT Math scale scores since the ACT data will be available for each graduating class.

Case study research using three to four school districts that have had significant upward trend data in this study could also provide more detailed information on the best practices of implementing increased graduation requirements. Interviewing counselors, administrators, and math teachers along with reviews of curriculum guides used for student scheduling could provide a list of best practices and procedures to increase the proportion of graduates completing three or more college preparatory math course and increases in college readiness assessments. Then other school leaders could refer the list of ideas for replication for improvement in their own respective schools.

The aforementioned suggestions for additional research would add to empirical evidence of the impact and appropriate implementation of the North Carolina Future Ready Core graduation requirements. However, implementing the first and third suggested research studies would require the cooperation of school districts or purposeful data collection on the part of the North Carolina Department of Public Instruction as per course enrollment patterns which is not currently readily accessible. Additionally, student achievement on college readiness assessments and post high school intention proportion rate also have several other external factors that are difficult to control for in studies that include the entire state's population. But with appropriate research design, the findings would be useful to school leaders to improve outcomes for graduates.

Conclusion

This study provided analysis of the impact of the implementation of North Carolina Future Ready Core graduation requirements. More specifically, high school mathematics course

enrollment patterns, college mathematic readiness, and post high school intentions at the state and sized-based school district subgroup levels were examined. Quantitative methodology analyzed the descriptive statistics of the proportions of graduates completing three or more college preparatory math courses, average SAT math scale score, and proportions of graduates reporting intent to attend two or four year-college throughout the implementation process of 2008 through 2013. All 115 North Carolina public school districts relevant data was utilized by accessing North Carolina Public School system webpage under Statistical Profile interactive app and annual SAT reports from 2008 through 2013.

The findings from this study pointed out Future Ready Core graduation requirements impacted significantly the proportion of graduates completing three or more college preparatory math courses and average SAT math scale scores at graduate and, or district average proportion levels in contrast to previous reported similar studies. The proportion of graduates completing three or more college preparatory math courses increased significantly at the graduate level at small, mid-size, and state level subgroups as well as at the district average level in all subgroups. Inversely, the average SAT math scale scores decreased significantly at graduate in small and mid-sized subgroups as well as district average level in small, mid-sized, and state subgroups. Over the course of the implementation of the Future Ready Core graduation requirements, the findings showed a closing of gaps between the size-based subgroups; however, the gaps between the size-based school district are still present.

The study's findings also presented two major findings for school leaders. The implementation of the more uniform, rigorous Future Ready Core graduation requirements positively impacted the proportion of graduates completing three or more college preparatory course more immediately than previous new policies' implementation; however, the substitution

option was selected 16.39% of the time at the state level in 2013 with higher percentages in small and mid-size school districts. Additionally, the decrease in student performance on the SAT math assessment even with increases in college preparatory coursework requires school leaders to examine the quality of teaching and learning as well potential unofficial tracking methods that may be occurring in the more uniform graduation requirements. Further research studies on the impact of the Future Ready Core graduation requirements could include analysis of total math coursework, repeating a similar study using ACT math composite scores after three graduating classes under the new requirements, or conducting a case study of districts who have had positive trend data while implementation the Future Ready Core graduation requirements as an exemplar for other school districts to follow.

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APPENDIX A: TABLES

Table A1

Proportion of High School Graduates Completing Three or More College Preparatory Math Courses

Year	N	Graduate	District Minimum	District Maximum	District Average	District Std. Deviation
2008	115	66.68	33.33	91.89	60.10	11.02
2009	115	65.94	27.5	91.74	59.81	10.48
2010	115	65.60	32.56	90.52	59.55	10.11
2011	115	66.69	40.00	89.56	61.05	9.91
2012	115	69.43	39.73	92.75	63.82	10.08
2013	115	83.61	50.00	95.96	79.82	9.23

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Table A2

Proportion of High School Graduates Completing Three or More College Preparatory Math Courses Based on School District Size Sub-Groups

School District Size		N	Graduate	District Minimum	District Maximum	District Average	District Std. Deviation
Small	2008	91	59.46	33.33	91.89	58.70	10.85
	2009	91	58.89	27.50	91.74	58.40	10.16
	2010	91	58.57	32.56	90.52	58.15	9.88
	2011	91	59.98	40.00	89.56	59.67	9.79
	2012	91	62.39	39.73	92.75	62.47	10.02
	2013	91	79.84	50.00	95.96	78.66	9.71
Mid-Size	2008	18	62.35	47.60	76.49	61.44	7.32
	2009	18	62.37	44.92	75.80	61.37	7.86
	2010	18	62.07	43.48	75.32	61.26	7.29
	2011	18	64.36	48.34	75.59	63.42	6.99
	2012	18	66.89	51.49	80.21	65.98	7.17
	2013	18	83.09	73.28	90.67	83.09	5.33
Large	2008	6	79.18	61.60	83.90	77.35	8.21
	2009	6	77.31	61.65	83.01	76.37	7.72
	2010	6	76.65	63.75	80.20	75.59	6.29
	2011	6	76.60	59.80	80.09	74.87	7.86
	2012	6	79.41	65.57	82.93	77.94	6.81
	2013	*6*	*88.11*	*81.17*	*90.49*	*87.73*	*3.36*

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Table A3

Average SAT Math Scale Scores Disaggregated by Sized Based Subgroups and Levels

School District Size		2008	2009	2010	2011	2012	2013
Small	N	91	91	91	91	91	91
	Graduate	500.95	501.28	499.92	495.05	493.51	489.54
	District Minimum	408.0	394.0	390.0	392.0	385.0	391.0
	District Maximum	596.0	598.0	605.0	596.0	605.0	604.0
	District Average	491.50	490.44	488.18	485.11	484.53	479.08
	District Std. Deviation	36.22	37.45	37.56	36.23	37.52	37.74
Mid-Size	N	18	18	18	18	18	18
	Graduate	514.02	512.23	510.81	508.47	505.47	502.54
	District Minimum	454.0	453.0	447.0	450.0	441.0	432.0
	District Maximum	543.0	540.0	547.0	536.0	533.0	531.0
	District Average	511.83	510.11	507.94	504.50	502.00	497.22
	District Std. Deviation	22.01	20.70	23.13	21.59	24.31	25.32

Table A3 (continued)

School District Size		2008	2009	2010	2011	2012	2013
Large	N	6	6	6	6	6	6
	Graduate	513.43	514.97	512.53	511.32	509.42	507.88
	District Minimum	477.0	479.0	475.0	476.0	473.0	461.0
	District Maximum	541.0	547.0	542.0	544.0	543.0	541.0
	District Average	504.17	505.00	502.00	500.33	499.17	497.00
	District Std. Deviation	22.68	23.44	24.25	25.38	25.99	26.77
State	N	115	115	115	115	115	115
	Graduate	509.22	509.51	507.84	505.07	503.08	500.40
	District Minimum	408.0	394.0	390.0	392.0	385.0	391.0
	District Maximum	596.0	598.0	605.0	596.0	605.0	604.0
	District Average	495.34	494.28	491.99	488.94	488.03	482.85
	District Std. Deviation	34.49	35.40	35.73	34.51	35.73	36.14

Table A4

Proportion of North Carolina Graduates Indicating Intent to Enroll in a Four-Year Colleges

School District Size		2008	2009	2010	2011	2012	2013
Small	N	91	91	91	91	91	91
	Graduate	40.26	39.37	39.72	39.02	38.43	38.82
	District Minimum	22.88	20.00	25.00	17.14	16.19	20.00
	District Maximum	81.75	81.01	79.59	76.75	81.45	77.39
	District Average	40.44	39.42	40.02	38.64	38.13	38.47
	District Std. Deviation	10.04	10.29	9.01	9.89	9.77	9.61
Mid-Size	N	18	18	18	18	18	18
	Graduate	42.42	41.59	42.16	41.98	41.18	42.26
	District Minimum	30.07	28.51	30.03	30.40	32.20	32.67
	District Maximum	59.14	54.03	55.04	52.68	54.74	53.23
	District Average	41.71	40.71	41.17	41.02	40.04	41.25
	District Std. Deviation	7.31	6.68	6.31	6.03	6.16	5.54

Table A4 (continued)

Large	N	6	6	6	6	6	6
	Graduate	59.46	57.05	57.79	56.23	54.96	53.34
	District Minimum	50.41	52.33	53.08	48.58	50.53	46.91
	District Maximum	65.84	65.14	64.50	60.14	58.24	57.86
	District Average	59.07	56.91	57.65	55.43	54.38	53.20
	District Std. Deviation	5.62	5.25	4.33	4.55	3.36	4.37
Total	N	115	115	115	115	115	115
	Graduate	47.11	45.82	46.44	45.65	44.80	44.77
	District Minimum	22.88	20.00	25.00	17.14	16.19	20.00
	District Maximum	81.75	81.01	79.59	76.75	81.45	77.39
	District Mean	41.62	40.54	41.12	39.89	39.28	39.68
	District Std. Deviation	10.30	10.32	9.28	9.89	9.73	9.46

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Table A5

Proportion of North Carolina Graduates Indicating Intent to Enroll in a Two-Year College

District School Size		2008	2009	2010	2011	2012	2013
Small	N	91	91	91	91	91	91
	Graduate	40.93	42.31	42.42	43.54	42.69	42.35
	District Minimum	9.18	12.21	11.91	15.18	12.41	14.30
	District Maximum	60.36	63.90	62.39	65.71	61.02	62.28
	District Average	39.72	41.62	41.20	43.20	41.50	41.39
	District Std. Deviation	10.12	10.01	9.64	9.89	8.99	9.55
Mid-Size	N	18	18	18	18	18	18
	Graduate	39.52	41.01	40.82	40.95	40.75	39.62
	District Minimum	31.30	33.24	32.01	32.53	32.44	31.43
	District Maximum	51.63	55.26	52.93	52.47	50.43	47.28
	District Average	39.97	41.78	41.79	41.77	41.50	40.54
	District Std. Deviation	4.95	5.77	5.85	5.44	5.02	4.92

Table A5 (continued)

District School Size		2008	2009	2010	2011	2012	2013
Large	N	6	6	6	6	6	6
	Graduate	27.75	30.29	29.49	30.20	30.52	31.86
	District Minimum	21.44	22.67	22.40	23.38	23.51	23.30
	District Maximum	33.89	35.78	34.08	34.40	34.81	35.93
	District Average	27.76	30.27	29.32	30.29	30.51	30.97
	District Std. Deviation	4.85	4.83	4.19	4.30	4.54	4.71
State	N	115	115	115	115	115	115
	Graduate	36.25	37.99	37.65	38.32	38.03	37.98
	District Minimum	9.18	12.21	11.91	15.18	12.41	14.30
	District Maximum	60.36	63.90	62.39	65.71	61.02	62.28
	District Average	39.14	41.05	40.68	42.30	40.93	40.72
	District Std. Deviation	9.63	9.57	9.30	9.52	8.63	9.05

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

Table A6

Proportion of North Carolina Graduates Indicating Intent to Enroll in a Four and Two-Year College

District School Size		2008	2009	2010	2011	2012	2013
Small	N	91	91	91	91	91	91
	Graduate	81.19	81.68	82.14	82.56	81.12	81.17
	District Minimum	63.14	62.60	59.70	59.93	58.48	57.38
	District Maximum	94.12	93.22	91.49	92.13	93.86	94.26
	District Average	80.17	81.04	81.23	81.83	79.64	79.87
	District Std. Deviation	6.52	5.68	6.20	6.11	6.21	7.28
Mid-Size	N	18	18	18	18	18	18
	Graduate	81.93	82.60	82.98	82.93	81.93	81.89
	District Minimum	74.92	67.31	71.74	74.06	73.54	75.28
	District Maximum	91.05	91.06	91.57	91.31	87.91	88.73
	District Average	81.68	82.50	82.96	82.78	81.54	81.78
	District Std. Deviation	4.53	5.00	4.71	4.07	4.00	4.06

Table A6 (continued)

District School Size		2008	2009	2010	2011	2012	2013
Large	N	6	6	6	6	6	6
	Graduate	87.21	87.34	87.28	86.43	85.47	85.20
	District Minimum	84.30	84.61	83.98	82.31	81.53	80.69
	District Maximum	88.41	88.82	89.19	89.35	88.35	87.67
	District Average	86.83	87.19	86.97	85.72	84.89	84.17
	District Std. Deviation	1.68	1.57	1.75	2.60	2.70	2.69
State	N	115	115	115	115	115	115
	Graduate	83.36	83.80	84.09	83.97	82.82	82.75
	District Minimum	63.14	62.60	59.70	59.93	58.48	57.38
	District Maximum	94.12	93.22	91.57	92.13	93.86	94.26
	District Average	80.75	81.59	81.80	82.19	80.21	80.39
	District Std. Deviation	6.25	5.60	5.97	5.75	5.90	6.77

Note. Proportions are expressed as percentages (percentage = 100 x proportion).

APPENDIX B: INSTITUTIONAL REVIEW BOARD APPROVAL

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
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600 Moye Boulevard · Greenville, NC 27834
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Notification of Exempt Certification

From: Social/Behavioral IRB
To: Christopher Weikart
CC: Marjorie Ringler
Date: 3/4/2015
Re: UMCIRB 14-001271
The Impact of the North Carolina Future Ready Core Graduation Requirements on high school mathematics course enrollment patterns, college mathematic readiness, and post high school intentions

I am pleased to inform you that your research submission has been certified as exempt on 3/4/2015. This study is eligible for Exempt Certification under category #4.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification request at least 30 days before the end of the five year period.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.